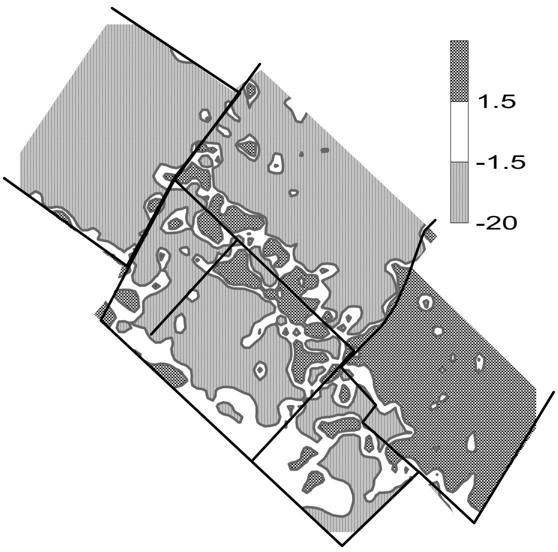
Table 3.8. Mean and 1 standard error (SE) for each predatory arthropod group across the six fields in 2002.

	June		July	
	Mean	SE	Mean	SE
Agonum dorsale	4.61	0.19	1.05	0.08
Bembidion lampros	0.39	0.05	0.24	0.02
Bembidion obtusum	0.11	0.01	0.02	0.01
Nebria brevicollis	0.69	0.03	0.28	0.02
Poecillus cupreus	0.74	0.10	0.33	0.07
Pterostichus madidus	26.29	1.58	46.11	1.95
Pterostichus melanarius	2.13	0.22	1.15	0.12
Total Carabidae	38.42	1.54	54.56	1.99
No. carabid species	4.80	0.07	4.68	0.07
Boundary overwintering Carabidae	5.81	0.20	1.77	0.09
Philonthus cognatus	13.67	0.37	1.91	0.11
Total Staphylinidae	17.57	0.44	3.65	0.14
No. Staphylinid species	2.76	0.05	1.48	0.04
Lycosidae	1.61	0.15	0.31	0.04
No. carabid & staphylinid species	7.56	0.09	6.15	0.09
Total predatory invertebrates	55.48	1.55	57.38	2.01
Boundary overwintering	6.91	0.21	2.06	0.10

In June 2001, most predators were captured in L3 (winter wheat) and in the smaller fields S1 and S2, whereas in July, the largest patches of high predator numbers were present in L2 and L3 (Fig. 3.9). In June 2002, the area containing the highest number of predators was in L3 (winter wheat), as found in the previous year and this extended across most of the sampled area (Fig. 3.10). Patches were also present in S1, S2 and L2. In July large patches of high numbers were found in L2 and L3.

Figure 3.6. Spatial clustering for boundary overwintering Carabidae in a) June 2001 and b) July 2001. The maps indicate clusters of relatively high counts (v_i>1.5) and small counts (v_j<-1.5).

a)



b)

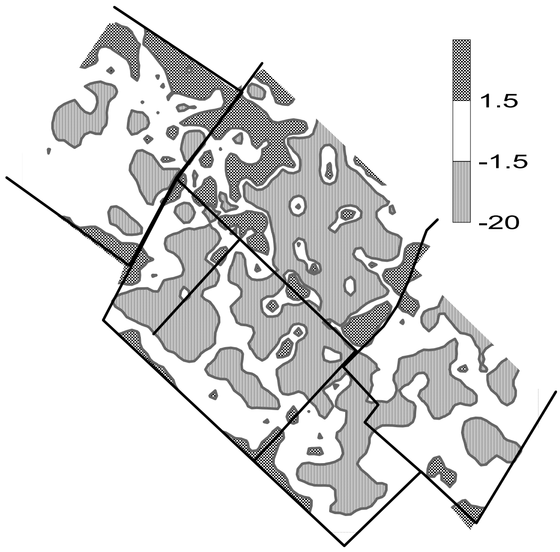


Figure 3.7. Spatial clustering for boundary overwintering Carabidae in a) June 2002 and b) July 2002. The maps indicate clusters of relatively high counts (v_i>1.5) and small counts (v_j<-1.5).

a)

b)

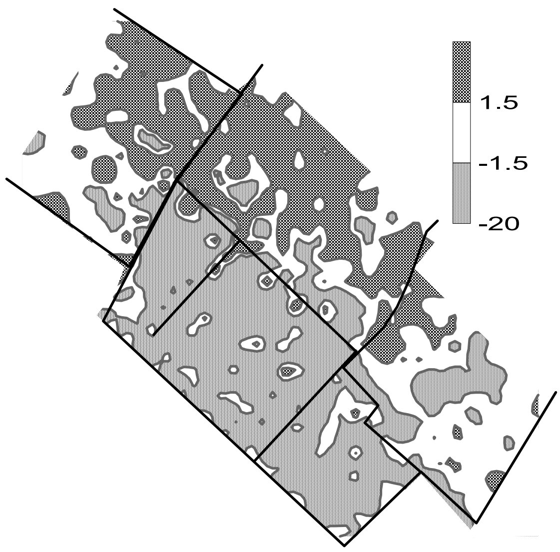


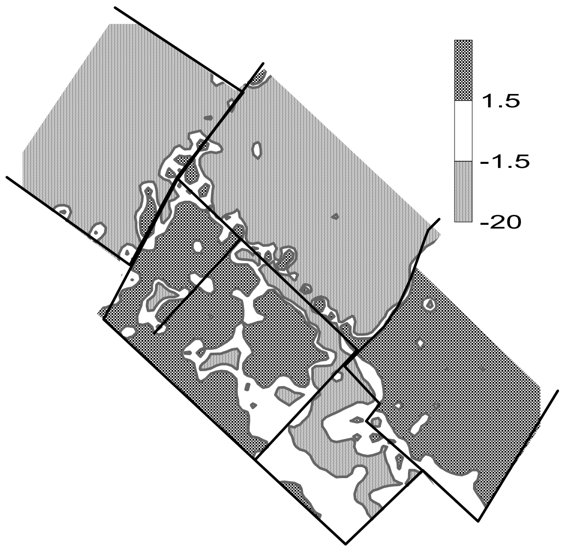
Figure 3.8. Spatial clustering for *P. madidus* in a) July 2001 and b) July 2002. The maps indicate clusters of relatively high counts (v_i>1.5) and small counts (v_j<-1.5).

a)

b)

Figure 3.9. Spatial clustering for total predators in a) June 2001 and b) July 2001. The maps indicate clusters of relatively high counts (v_i>1.5) and small counts (v_j<-1.5).

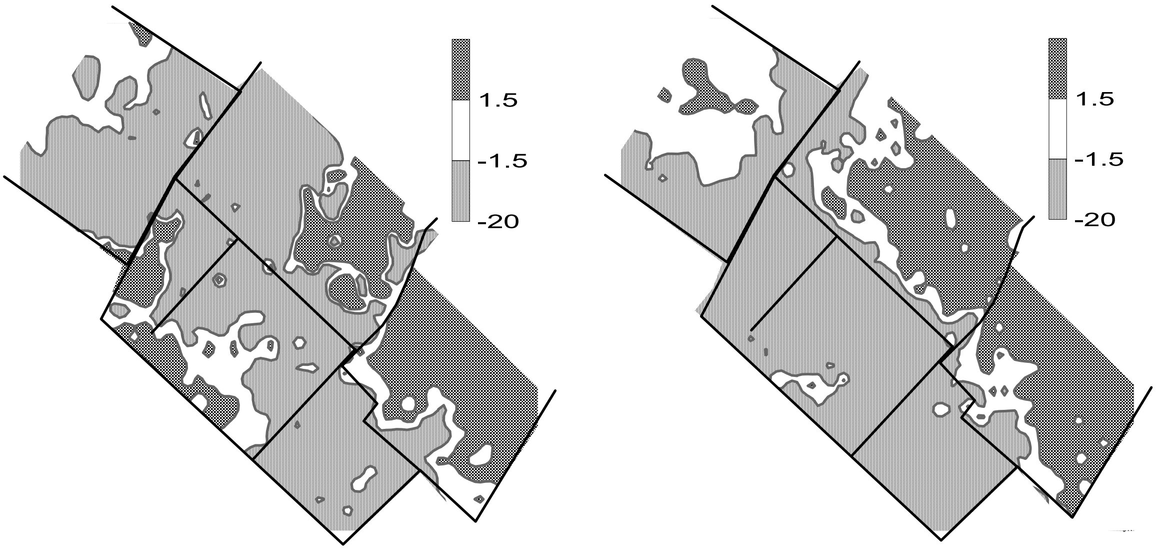
a)



b)

Figure 3.10. Spatial clustering for total predators in a) June 2002 and b) July 2002. The maps indicate clusters of relatively high counts (v_i>1.5) and small counts (v_j<-1.5).

a) b)



3.2.2.3. ***The stability of spatial pattern within years***

Within year stability was tested by comparing the spatial distribution between the four sampling occasions in 2000, and two occasions in 2001 and 2002, using the SADIE association test. The location of patches and gaps remained consistent between sampling occasions for most of the species analysed (Table 3.9). The distribution of *P. madidus* changed between May and June, because in May adults that had overwintered were captured, whereas the new generation of adults were captured from June onwards. The absence of spatial stability for *P. cognatus* in June to July coincided with a decline in abundance.

All the various groups, with the exception of the staphylinid species, showed considerable spatial stability in 2000 (Table 3.10). The boundary overwintering Carabidae and total Staphylinidae differed in their location between June and mid July in 2001 and 2002.

3.2.2.4. ***The stability of spatial pattern between years***

The degree of stability varied between the species and invertebrate groups but also between June and July (Tables 3.11 & 3.12). For example, the location of *P. melanarius* was consistent between years in June but not in July for 2000 and 2001. The change in the location of *P. madidus* may have been linked to cropping. In 2000, *P. madidus* was most abundant in S1-3 and L3 (Fig. 3.4) and in 2001 in L1 and L2 (Fig. 3.8), which were all in peas. However, they were also high in the winter wheat grown in L3 in 2001 (Fig. 3.8). In 2002 only cereal crops were available. Some species e.g. *Agonum dorsale*, a boundary overwintering species, showed no consist trend, with association, disassociation and no significant difference all occurring.

Table 3.9. Association indices comparing distribution of the insect species within years. (***=P_D<0.001 or >0.999, **= P_D<0.01 or >0.99, **= P_D<0.05 or >0.975)

	2000		2001		2002	
	X	P_D	X	P_D	X	P_D
Agonum dorsale						
May-June	0.45	***				
June-early July	0.47	***	0.24	***	-0.01	NS
Early-mid July	0.48	***				
May-mid July	0.45	***				
B. lampros						
May-June	0.32	***				
June-early July	0.38	***	0.38	***	0.25	***
Early-mid July	0.37	***				
May-mid July	0.10	**				
Philonthus cognatus						
May-June	0.56	***				
June-early July	-0.02	NS	-0.10	NS	0.02	NS
Early-mid July	0.28	***				
May-mid July	0.14	**				
Poecillus cupreus						
May-June	0.62	***				
June-early July	0.61	***	0.48	***	0.07	NS
Early-mid July	0.47	***				
May-mid July	0.48	***				
P. madidus						
May-June	-0.28	***				
June-early July	0.68	***	0.25	***	0.72	***
Early-mid July	0.83	***				
May-mid July	-0.37	***				
P. melanarius						
May-June	0.57	***				
June-early July	0.88	***	0.70	***	0.80	***
Early-mid July	0.91	***				
May-mid July	0.52	***				

There was little consistency in the results comparing distribution between years for the various groups, with the exception of the number of carabid species in July (Table 3.12). This group showed a positive association between each year indicating that patches and gaps with the highest and lowest number of species respectively, remained in the same location between years.

Table 3.10. Association indices comparing distribution of the insect groups within years. (***=P_D<0.001 or >0.999, **= P_D<0.01 or >0.99, **= P_D<0.05 or >0.975)

	2000		2001		2002	
	X	P_D	X	P_D	X	P_D
Boundary Carabidae						
May-June	0.36	***				
June-early July	0.40	***	-0.03	NS	0.07	*
Early-mid July	0.29	***				
May-mid July	0.16	***				
Total Carabidae						
May-June	0.45	***				
June-early July	0.35	***	0.11	*	0.63	***
Early-mid July	0.83	***				
May-mid July	0.34	***				
Carabid spp.						
May-June	0.34	***				
June-early July	0.48	***	0.2	***	0.22	***
Early-mid July	0.46	***				
May-mid July	0.25	***				
Total Staphylinidae						
May-June	0.55	***				
June-early July	0.03	0.36	-0.06	NS	-0.27	***
Early-mid July	0.27	***				
May-mid July	0.17	***				
Staphylinid spp.						
May-June	-0.04	0.79				
June-early July	0.02	0.34	0.22	***	0.10	*
Early-mid July	0.19	***				
May-mid July	0.24	***				
Carabid & Staphylinid spp.						
May-June	0.99	***				
June-early July	0.34	***	0.18	***	0.19	***
Early-mid July	0.47	***				
May-mid July	0.33	***				
Boundary species						
May-June	0.43	***				
June-early July	0.13	0.005	-0.16	NS	0.1	**
Early-mid July	0.29	***				
May-mid July	0.21	***				
Total predators						
May-June	0.36	***				
June-early July	0.40	***	0.03	NS	0.38	***
Early-mid July	0.29	***				
May-mid July	0.16	***				

Table 3.11. Association indices comparing distribution of insect species between years for sampling conducted in June and July each year.
(***=P_D<0.001 or >0.999, **= P_D<0.01 or >0.99, **= P_D<0.05 or >0.975)

	2000-01		2001-02		2000-02	
	X	P_D	X	P_D	X	P_D
Agonum dorsale						
June	-0.01	NS	-0.09	NS	0.27	***
July	0.003	NS	-0.11	**	-0.13	**
B. lampros						
June	0.09	NS	0.33	***	0.22	***
July	0.09	NS	0.22	***	0.18	**
Philonthus cognatus						
June	-0.44	>0.999	0.28	**	0.2	**
July	0.09	NS	0.13	**	0.08	NS
Poecillus cupreus						
June	0.28	***	0.03	NS	0.22	***
July	-0.18	**	0.15	*	0.03	NS
P. madidus						
June	0.43	***	0.38	***	0.17	***
July	<0.001	NS	0.65	***	-0.06	NS
P. melanarius						
June	0.75	***	0.77	***	0.88	***
July	-0.19	**	-0.13	NS	0.78	***

3.2.2.5. ***Association between invertebrate distribution and weed cover***

Total vegetation and weed cover increased from May through to July in 2000, with patches developing along the field margins and within some fields (Fig. 3.11 a-c). From 2000 to 2002 weed cover increased within field L3 but decreased in the other fields (Fig. 3.11 d-f). The set-aside strips (Fig. 3.1) developed very high weed cover. The SADIE analysis confirmed that the total vegetation and weed cover were aggregated into patches (Table 3.13).

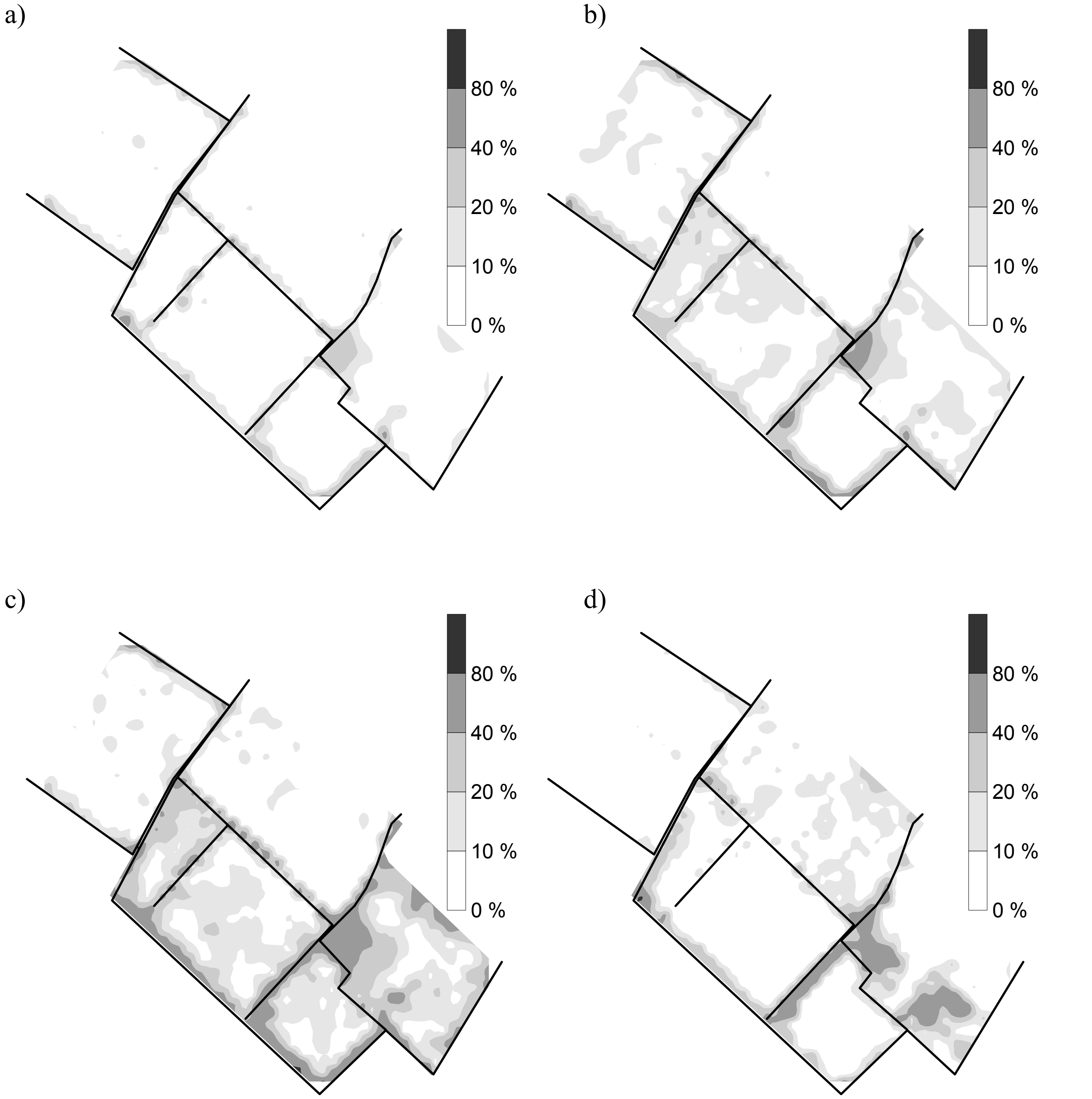
Table 3.12. Association indices comparing distribution of insect groups between years for sampling conducted in June and July each year.
(***=P_D<0.001 or >0.999, **= P_D<0.01 or >0.99, **= P_D<0.05 or >0.975)

	2000-01		2001-02		2000-02	
	X	P_D	X	P_D	X	P_D
Boundary Carabidae						
June	-0.13	**	-0.16	***	0.13	***
July	0.12	**	0.15	***	-0.01	NS
Total Carabidae						
June	0.06	NS	0.19	***	-0.38	***
July	-0.05	0.7	0.57	***	-0.17	NS
No. Carabid spp						
June	0.08	*	0.09	NS	0.26	***
July	0.22	***	0.16	***	0.23	***
Total Staphylinidae						
June	-0.39	***	0.21	*	0.31	***
July	-0.07	NS	0.16	**	-0.06	NS
No. Staphylinid spp.						
June	-0.11	**	0.03	NS	0.12	**
July	0.09	NS	-0.14	NS	0.16	***
No. Carabid & Staphylinid spp.						
June	-0.05	NS	0.03	NS	0.33	***
July	0.29	***	0.10	**	0.21	***
Boundary species						
June	0.16	***	-0.13	***	0.12	**
July	0.13	***	0.06	NS	-0.08	*
Total predators						
June	-0.13	NS	0.31	***	-0.28	**
July	-0.22	**	0.46	***	-0.32	**

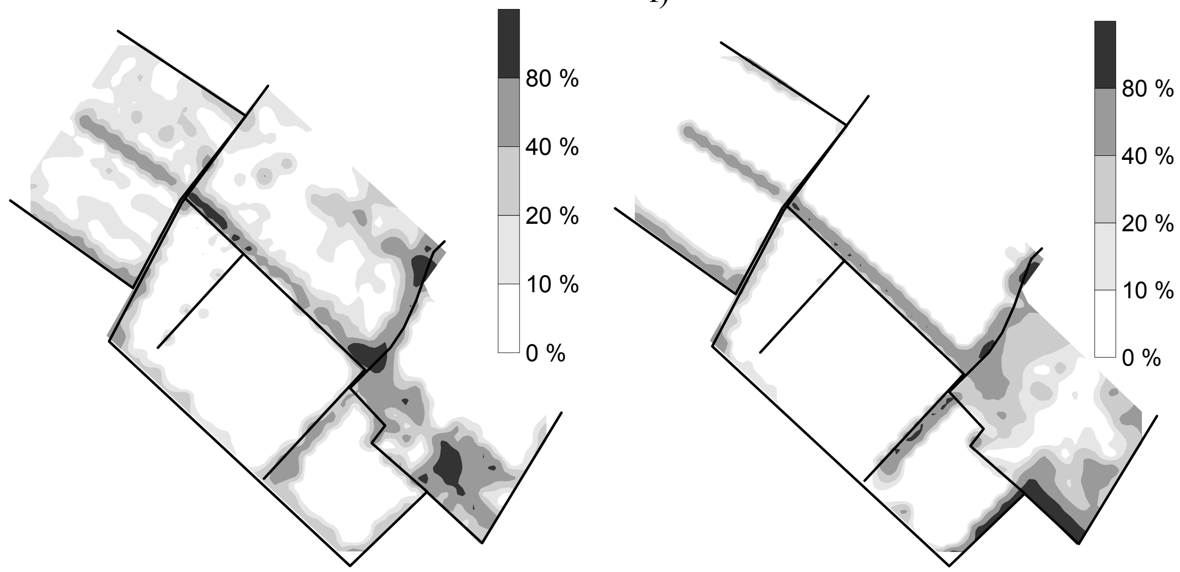
Table 3.13. Degree of clustering into 'patches' using overall index $\bar{v}_i$ and associated probability P_i, or of 'gaps' using overall index $\bar{v}_j$ and associated probability P_j for total vegetation and weed cover across the six fields in each year. (***=P<0.001, **= P<0.01, **= P<0.05).

Total vegetation cover						
	May-00	Jun-00	Jul-00	Jun-01	Jul-01	Jun-02
$\bar{v}_j$	-4.51	-2.84	-8.11	-2.04	-1.93	-6.66
P_j	***	***	***	***	***	***
$\bar{v}_i$	4.33	2.74	8.54	1.94	1.92	6.98
P_i,	***	***	***	***	***	***
Total weed cover						
$\bar{v}_j$	-1.29	-1.81	-3.46	-3.35	-1.98	-3.29
P_j	*	**	***	***	***	***
$\bar{v}_i$	1.35	2.01	3.71	3.10	1.94	4.10
P_i,	*	***	***	***	***	***

Figure 3.11. Percentage weed cover in a) May 2000, b) June 2000, c) July 2000, d) June 2001 e) July 2001 and f) June 2002.



e) f)



The insect species tested varied in their level of association with total vegetation and weed cover (Tables 3.14 & 3.15). Some species, e.g. *P. madidus*, were consistently associated with weed cover, whereas others showed disassociation or no consistent relationship. Overall, twice as many positive significant associations compared to disassociations were found for the species and total vegetation cover. However, all but one of the significant associations were positive when weed cover was compared, indicating that this was influencing the distribution pattern more than total vegetation cover.

Table 3.14. Association indices comparing distribution of insect species with that of total vegetation cover for sampling conducted in each year.
(***=P_D<0.001 or >0.999, **= P_D<0.01 or >0.99, **= P_D<0.05 or >0.975)

	May-00		June-00		early July-00		mid July-00	
	X	P_D	X	P_D	X	P_D	X	P_D
A. dorsale	-0.28	***	0.13	*	-0.02	NS	-0.13	*
B. lampros	-0.19	***	0.08	NS	0.01	NS	0.15	**
P. cupreus	-0.09	NS	0.16	*	0.50	***	0.42	***
P. madidus	0.44	***	0.35	***	0.72	***	0.73	***
P. melanarius	0.09	NS	0.06	NS	0.16	*	0.14	NS
P. cognatus	0.36	***	-0.30	***	0.45	***	0.05	NS
	June-01		**July-01**		**June-02**		**July-02**	
	X	**P_D**	**X**	**P_D**	**X**	**P_D**	**X**	**P_D**
A. dorsale	-0.14	NS	-0.05	NS	-0.11	*	0.01	NS
B. lampros	0.21	**	0.26	***	-0.12	*	-0.03	NS
P. cupreus	0.05	NS	0.21	**	0.22	***	0.04	NS
P. madidus	-0.01	NS	0.20	**	0.40	***	0.31	***
P. melanarius	-0.15	NS	-0.17	**	-0.40	***	-0.45	***
P. cognatus	-0.24	**	0.42	***	-0.14	**	0.02	NS

Table 3.15. Association indices comparing distribution of insect species with that of total weed cover for sampling conducted in each year.

(***=P_D<0.001 or >0.999, **= P_D<0.01 or >0.99, **= P_D<0.05 or >0.975)

	May-00		**June-00**		**early July-00**		**mid July-00**	
	X	**P_D**	**X**	**P_D**	**X**	**P_D**	**X**	**P_D**
A. dorsale	0.22	***	0.28	***	0.09	0.03	0.13	*
B. lampros	0.20	***	0.30	***	0.21	***	0.15	**
P. cupreus	0.14	**	0.32	***	0.39	***	0.42	***
P. madidus	-0.08	NS	0.23	***	0.40	***	0.73	***
P. melanarius	0.16	***	0.22	***	0.18	*	0.14	NS
P. cognatus	-0.01	NS	-0.05	0.80	0.31	**	0.05	NS
	June-01		**July-01**		**June-02**		**July-02**	
	X	**P_D**	**X**	**P_D**	**X**	**P_D**	**X**	**P_D**
A. dorsale	0.18	**	0.03	NS	-0.08	NS	0.12	NS
B. lampros	0.00	NS	0.18	***	0.05	NS	0.03	NS
P. cupreus	-0.16	***	0.07	NS	0.30	***	0.08	NS
P.madidus	0.21	***	0.20	**	0.23	***	0.24	***
P. melanarius	-0.01	NS	-0.18	**	-0.36	***	-0.40	***
P. cognatus	0.17	**	0.31	***	-0.13	NS	0.15	**

Table 3.16. Association indices comparing distribution of insect groups with that of total vegetation cover for sampling conducted in each year.

(***=P_D<0.001 or >0.999, **= P_D<0.01 or >0.99, **= P_D<0.05 or >0.975)

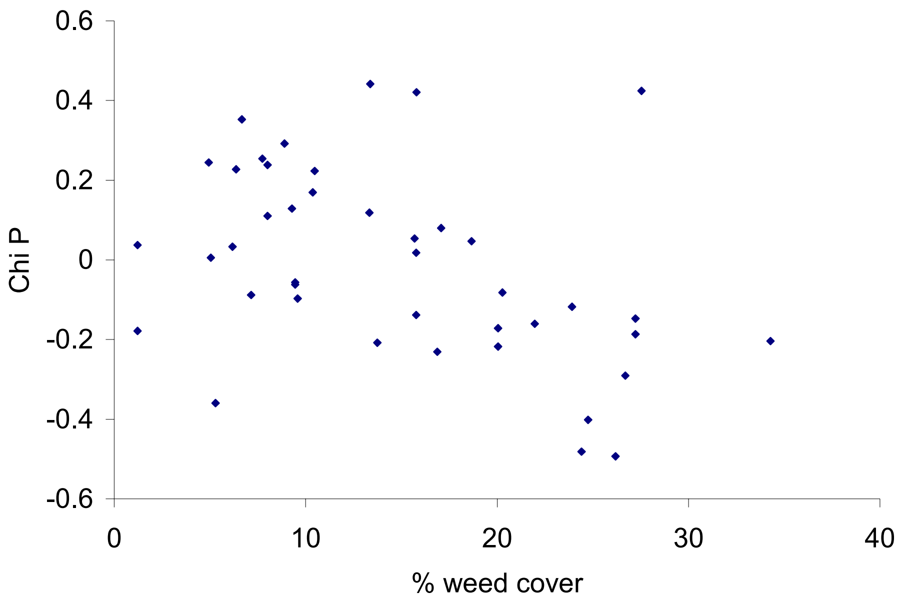
	May-00		**June-00**		**early July-00**		**mid July-00**	
	X	**P_D**	**X**	**P_D**	**X**	**P_D**	**X**	**P_D**
Total Carabidae	-0.28	***	0.18	*	0.72	***	0.73	***
Carabid spp.	-0.07	NS	0.00	NS	-0.18	***	-0.18	***
Boundary Carabidae	-0.32	***	0.00	NS	-0.12	**	-0.07	NS
Total Staphylinidae	0.20	***	-0.31	***	0.43	***	0.04	NS
Staphylinid spp.	0.34	***	-0.03	NS	0.08	NS	-0.19	***
Carabid & Staphylinid spp.	0.08	NS	0.06	NS	-0.14	**	-0.20	***
Boundary species	-0.38	***	0.30	***	-0.06	NS	-0.02	NS
Total predators	0.01	NS	-0.03	NS	0.73	***	0.72	***
	June-01		**July-01**		**June-02**		**July-02**	
	X	**P_D**	**X**	**P_D**	**X**	**P_D**	**X**	**P_D**
Total Carabidae	-0.02	NS	0.26	***	0.42	***	0.28	***
Carabid spp.	0.03	NS	0.22	***	-0.28	***	-0.35	***
Boundary Carabidae	0.04	NS	0.13	**	-0.14	**	-0.07	NS
Total Staphylinidae	-0.21	*	0.35	***	-0.14	**	0.01	NS
Staphylinid spp.	-0.09	NS	0.14	**	-0.24	***	-0.16	***
Carabid & Staphylinid spp.	-0.10	NS	0.25	***	-0.32	***	-0.34	***
Boundary species	-0.01	NS	0.13	**	-0.10	**	-0.02	NS
Total predators	-0.17	NS	0.37	***	0.37	***	0.26	***

Table 3.17. Association indices comparing distribution of insect groups with that of total weed cover for sampling conducted in each year.

(***=P_D<0.001 or >0.999, **= P_D<0.01 or >0.99, **= P_D<0.05 or >0.975)

	May-00		**June-00**		**early July-00**		**mid July-00**	
	X	**P_D**	**X**	**P_D**	**X**	**P_D**	**X**	**P_D**
Total Carabidae	0.33	***	0.33	***	0.43	***	0.73	***
Carabid spp.	0.24	***	0.27	***	-0.03	NS	-0.18	***
Boundary Carabidae	0.34	***	0.27	***	0.05	NS	-0.07	NS
Total Staphylinidae	-0.07	NS	-0.03	NS	0.32	***	0.04	NS
Staphylinid spp.	0.00	NS	0.08	NS	0.07	NS	-0.19	***
Carabid & Staphylinid spp.	0.19	***	0.16	**	-0.01	NS	-0.20	***
Boundary species	0.17	**	0.30	***	0.09	NS	-0.02	NS
Total predators	0.15	**	0.23	***	0.42	***	0.15	**
	June-01		**July-01**		**June-02**		**July-02**	
	X	**P_D**	**X**	**P_D**	**X**	**P_D**	**X**	**P_D**
Total Carabidae	0.38	***	0.25	**	0.26	**	0.23	**
Carabid spp.	0.08	*	0.20	**	-0.18	***	-0.21	***
Boundary Carabidae	0.28	***	0.11	**	-0.07	NS	0.02	NS
Total Staphylinidae	0.38	***	0.27	***	-0.11	NS	0.16	**
Staphylinid spp.	0.20	***	0.15	**	-0.16	***	-0.04	NS
Carabid & Staphylinid spp.	0.21	***	0.21	**	-0.17	***	-0.15	***
Boundary species	0.29	***	0.12	*	-0.05	NS	0.04	NS
Total predators	0.23	***	0.35	***	0.24	***	0.22	**

Figure 3.12. Relationship between weed cover and strength of predator to weed cover correlation.



For the different insect groups, the relationship with total vegetation cover was often inconsistent between years and consequently no firm conclusions could be made based upon this level of analysis (Table 3.16). Cover increased during the summer and thus the environmental conditions may have changed making areas more or less suitable for each species. A field by field analytical approach may be more suitable because cover varied quite considerably between fields and such an analysis is underway. In contrast, stronger correlations were found with weed cover, notably for total Carabidae and total predators (Table 3.17). To examine this further the percentage weed cover was plotted in relation to the correlation value between weed cover and predators (Fig. 3.10). This indicated that there may be an optimum level of weed cover (10-14%), beyond which the number of predators declined.

3.2.2.6 ***Association between invertebrate distribution and soil moisture.***

In the summer of 2000, the soil moisture was highest in L1, with wetter patches of relatively small sizes occurring within the other fields (Fig. 3.11). Dry patches occurred where the chalk was exposed on the higher ground. Few significant correlations were found for the individual species but there was a trend towards disassociation, suggesting that there was a negative relationship between soil moisture and beetle abundance (Table 3.18). Only significant disassociation was found for the invertebrate groups indicating further that there was a negative relationship between the majority of the epigeal invertebrates and soil moisture in the summer (Table 3.19).

To test whether the wetter areas persisted in the same location from year to year and from winter to summer, the data from the summer of 2000 and the autumn of 2001 were compared for each field and for the whole study area using SADIE. There was no significant association (Table 3.20), except in fields S1 and S2. S1 had a relatively high soil moisture content across the whole field on both occasions. S2 was characterised by an area of low soil moisture across half of the field, where the soil had a high chalk content.

Table 3.18. Association indices comparing distribution of insect species with that of soil moisture in 2000. (***=P_D<0.001 or >0.999, **= P_D<0.01 or >0.99, **= P_D<0.05 or >0.975)

	May-00		**Jun-00**		**Early July-00**		**Late July-00**	
	X	**P_D**	**X**	**P_D**	**X**	**P_D**	**X**	**P_D**
A. dorsale	0.10	NS	-0.13	NS	-0.06	NS	-0.04	NS
B. lampros	0.14	*	0.03	NS	0.03	NS	-0.14	*
P. cupreus	-0.12	NS	-0.06	NS	-0.12	NS	-0.18	NS
P. madidus	0.01	NS	-0.14	NS	-0.16	NS	-0.17	NS
P. melanarius	0.00	NS	-0.23	NS	-0.26	*	-0.26	**
P. cognatus	0.16	NS	0.14	*	-0.15	NS	-0.15	*

Table 3.19. Association indices comparing distribution of insect groups with that of soil moisture in 2000. (***=P_D<0.001 or >0.999, **= P_D<0.01 or >0.99, **= P_D<0.05 or >0.975)

	May-00		Jun-00		Early July-00		Late July-00	
	X	P_D	X	P_D	X	P_D	X	P_D
Total Carabidae	0.04	NS	-0.16	NS	-0.21	*	-0.19	NS
Carabid spp.	0.02	NS	-0.29	NS	-0.11	*	-0.14	**
Boundary Carabidae	0.17	*	-0.01	NS	-0.05	NS	-0.17	***
Total Staphylinidae	0.09	NS	0.13	NS	-0.11	*	-0.14	*
Staphylinid spp.	0.08	NS	0.02	NS	0.10	NS	0.06	NS
Carabid & Staphylinid spp.	0.03	NS	0.03	NS	-0.11	*	-0.11	*
Boundary species	-0.20	**	-0.13	*	-0.01	NS	-0.18	***
Total predators	0.12	NS	-0.07	NS	-0.17	NS	-0.16	NS

Figure 3.13. Soil moisture in a) June-July 2000 (Readings are volumetric water content m^3m^{-3} $x10^3$) and b) November 2001 (Readings are EMI).

a) b)

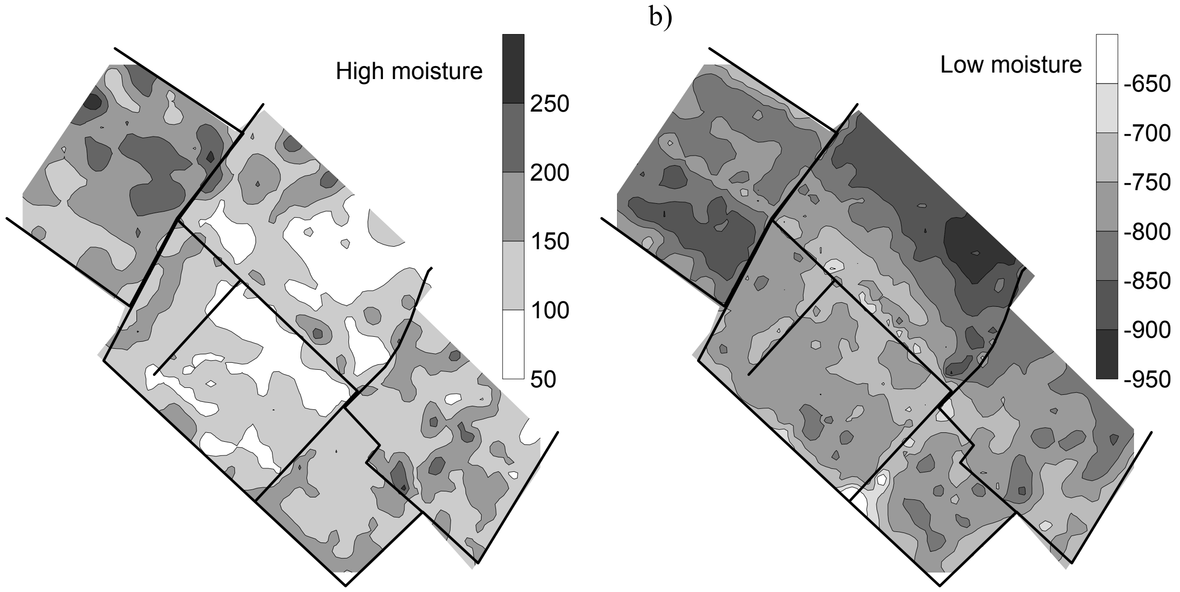


Table 3.20. Association indices comparing soil moisture in the summer of 2000 with autumn 2001. (***=P_D<0.001 or >0.999, **= P_D<0.01 or >0.99, **= P_D<0.05 or >0.975)

2000-02	L1	L2	L3	S1	S2	S3	All fields
X	-0.22	0.15	0.004	0.23	0.19	0.14	0.25
P_D	0.98	NS	0.48	*	**	0.13	NS

3.2.2.7. Effect of cropping and field size on invertebrate community composition

Routines in PRIMER were used to establish the difference in invertebrate community composition between crops. The ANOSIM analysis of the June pitfall data showed that there was an overall difference between crops (Global R = 0.66, significance = 0.2%). The pair-wise tests shown in Table 3.21 confirmed that the differences lay between cereals and legumes. The R value between winter wheat and peas was relatively high; this was the only significant comparison.

Table 3.21. Pairwise comparisons showing similarity of crops in June (accounting for year by year differences).

Crops	**R Statistic**	**Significance (%)**
Wheat, Barley	0.37	10
Wheat, Peas	0.96	1.3
Barley, Peas	0.58	40

SIMPER was used to quantify the differences in community composition between these crops (Table 3.22). The species which contributed most to the differences were the carabid *P. madidus* and the staphylinid *P. cognatus*, both of which were more abundant in winter wheat and the carabid *P. melanarius* (which was more abundant in peas). Other taxa each contributed <10% to the difference.

Table 3.22. The difference in invertebrate community composition between winter wheat and peas in June (all years).

Taxa	**Abundance winter wheat**	**Abundance peas**	**Av.Diss**	**Diss/SD**	**Contrib%**	**Cum.%**
P. madidus	17.61	5.16	13.44	0.75	20.31	20.31
P. cognatus	16.17	12.16	12.75	1.2	19.26	39.58
P. melanarius	0.66	21.85	11.21	0.62	16.94	56.52
Curculionidae	0.17	6.37	7.46	1.05	11.27	67.79
Chrysomelidae	0.4	4.07	4.78	0.84	7.22	75.01
Tachyporus hypnorum	1.12	3.35	2.99	1.32	4.53	79.53
Nebria spp.	3.45	2.4	2.96	0.89	4.47	84
Agonum dorsale	2.72	1.26	2.33	0.92	3.52	87.52
Poecillus cupreus	0.56	2.36	1.48	1.59	2.23	89.75
Bembidion lampros	0.61	2.16	1.36	1.91	2.06	91.81

In July, the Global R value was 0.76 (significance =0.3%) indicating that there were differences in the invertebrate community composition between crops; the pair-wise differences (Table 3.23) showed that, as in June, only the difference between winter wheat and peas was significant at 5%.

These differences were characterised using SIMPER as shown in Table 3.24. In July, the majority of the difference was accounted for by *P. madidus* (43%) which occurred in greater numbers in peas. This was the reverse of the situation in June. The pattern for *P. melanarius* did not change, numbers remained higher in pea fields.

Table 3.23. Pairwise comparisons showing similarity of crops in July (accounting for year by year differences).

Crops	R Statistic	Significance (%)
Wheat, peas	0.93	1.3
Wheat, barley	0.85	10
Peas, barley	0.50	20

Table 3.24. The difference in invertebrate community composition between winter wheat and peas in July 2002.

Taxa	Abundance winter wheat	Abundance peas	Av.Diss	Diss/SD	Contrib%	Cum.%
P. madidus	34.39	103.92	42.85	1.64	69.88	69.88
P. melanarius	1.77	15.99	7.6	0.67	12.39	82.27
Curculionidae	0.05	2.98	3.17	0.66	5.17	87.44
P. cognatus	3.34	4.93	2.24	0.68	3.65	91.09

3.2.3. Conclusions

1. Field boundaries were most important as a source of beneficial insects earlier in the year (May and June), whereas mid-field overwintering species were most numerous in July.
2. Boundary overwintering species remained associated with the boundaries throughout the spring and summer and only penetrated to the centre of the smallest field (4ha).
3. All beneficial invertebrate species and groups were heterogeneously distributed across the six fields and often within fields.
4. The location of the patches and gaps was relatively stable within years for most insect species and groups.
5. The location of the patches and gaps between years varied between species and for the groups.
6. The vegetation cover was heterogeneous across the study area and within fields.
7. Weed cover had a greater influence on the invertebrate distribution than total vegetation cover (crop and weeds). Many of the invertebrate species, total numbers of Carabidae and predators were positively associated with weed cover.

8. The weed patches with 10-14% cover were the most strongly associated with high numbers of predatory invertebrates.
9. In the summer, many of the invertebrate groups were disassociated with areas of high soil moisture.
10. The spatial pattern of soil moisture levels in winter were generally not related to patterns in the summer.
11. The invertebrate species composition differed between the peas and winter wheat, but not the other crops.