



The importance of salt marshes for the conservation of invertebrates

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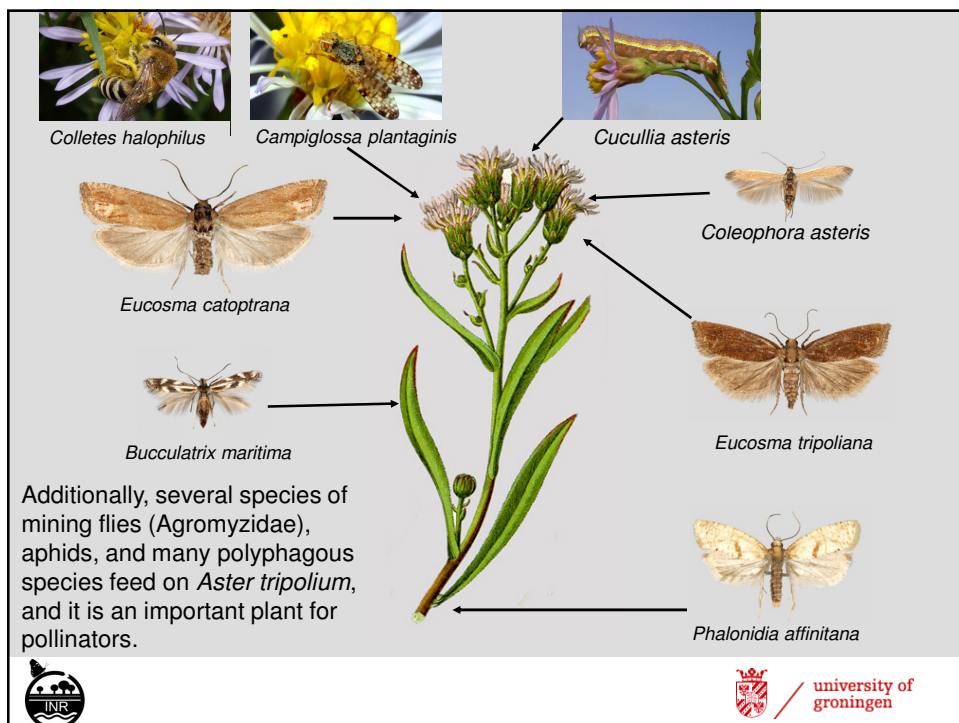
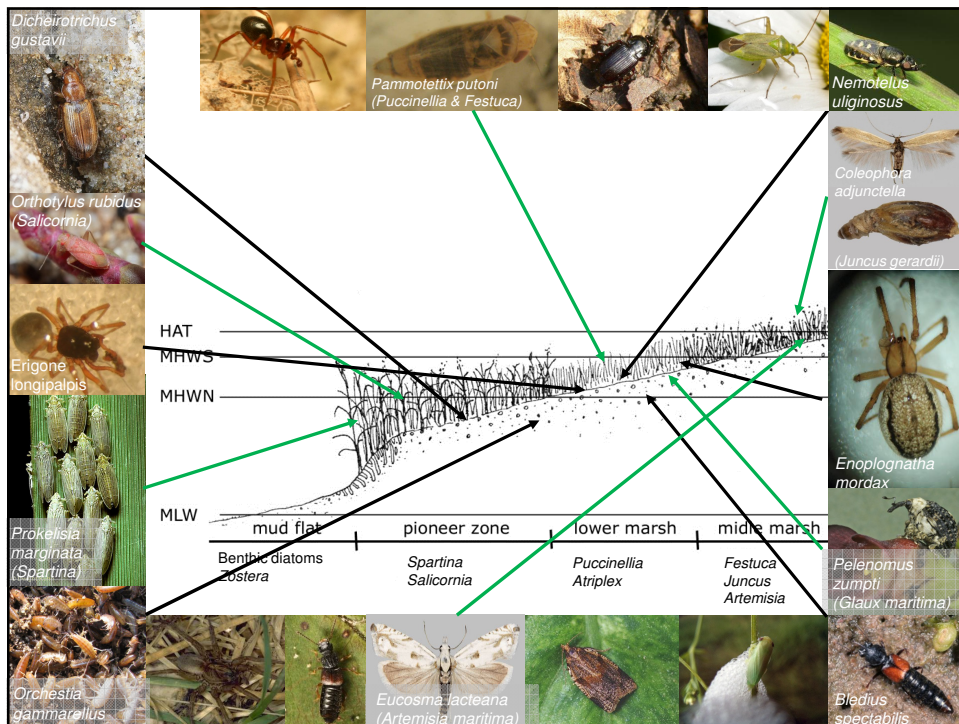
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Invertebrates on salt marshes

- Many species are confined to saline habitats through host-plant associations, or otherwise.
- They often have physical adaptations to deal with habitat specific stressors such as salt and inundation.
- Invertebrate communities are characterized by a mix of extreme generalists and specialists.
- They have a central place in food webs: food for insectivorous breeding birds, fish and each other.





Distribution patterns

Bembidion normannum



Dicheirotrichus gustavii



Source: Turin 2000



Species only occurring on salt marshes in NW Europe

	Species restricted to salt marshes	Number of species in N-W Europe
Spiders (Araneae)		
Beetles (Coleoptera)		
-Weevils		
-Ground beetles (Carabidae)		
-Rove beetles (Staphylinidae)		
-Other beetles		
Plant- and leafhoppers		
True bugs (Heteroptera)		
Hoverflies (Syrphidae)		
Fruit flies (Tephritidae)		
Picture-winged flies (Ulidiidae)		
Moths (Lepidoptera)		
TOTAL		



Species only occurring on salt marshes in N-W Europe

	Species restricted to salt marshes	Number of species in N-W Europe
Spiders (Araneae)	6	>800
Beetles (Coleoptera)	66	>6000
-Weevils	5	>800
-Ground beetles (Carabidae)	14	>600
-Rove beetles (Staphylinidae)	31	>1500
-Other beetles	16	>5000
Plant- and leafhoppers	6	>600
True bugs (Heteroptera)	>8	>800
Hoverflies (Syrphidae)	2	>600
Fruit flies (Tephritidae)	1	>100
Picture-winged flies (Ulidiidae)	3	>100
Moths (Lepidoptera)	17	>3000
TOTAL	>118	



Also endemic species!

Praestigia duffeyi

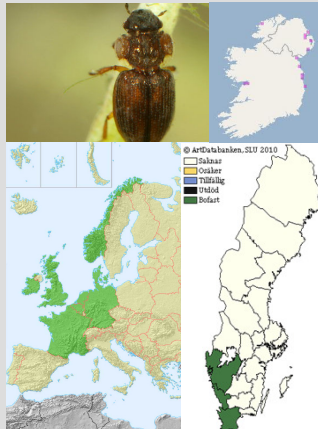


Whittleia retiella



Also endemic species!

Ochthebius auriculatus



Anoscopus limicola



Species dependent on salt marshes endemic to NW Europe

	Species restricted to salt marshes	Endemic salt- marsh species	Number of species in N-W Europe
Spiders (Araneae)	6		>800
Beetles (Coleoptera)	66		>6000
-Weevils	5		>800
-Ground beetles (Carabidae)	14		>600
-Rove beetles (Staphylinidae)	31		>1500
-Other beetles	16		>5000
Plant- and leafhoppers	6		>600
True bugs (Heteroptera)	>8		>800
Hoverflies (Syrphidae)	2		>600
Fruit flies (Tephritidae)	1		>100
Picture-winged flies (Ulidiidae)	3		>100
Moths (Lepidoptera)	17		>3000
TOTAL	>118		



Species dependent on salt marshes endemic to NW Europe

	Species restricted to salt marshes	Endemic salt- marsh species	Number of species in N-W Europe
Spiders (Araneae)	6	2	>800
Beetles (Coleoptera)	66	10	>6000
-Weevils	5	-	>800
-Ground beetles (Carabidae)	14	1 ssp	>600
-Rove beetles (Staphylinidae)	31	3	>1500
-Other beetles	16	6 sp; 1 ssp	>5000
Plant- and leafhoppers	6	2	>600
True bugs (Heteroptera)	>8	?	>800
Hoverflies (Syrphidae)	2	-	>600
Fruit flies (Tephritidae)	1	-	>100
Picture-winged flies (Ulidiidae)	3	-	>100
Moths (Lepidoptera)	17	1	>3000
TOTAL	>118	>15	



Conservation of salt-marsh invertebrates

- History of intensive grazing of NW European salt marshes
- After abandonment, encroachment of late-successional species (*Elytrigia atherica*, *Atriplex portulacoides*, *Phragmites australis*) is a great threat to many species.
- Adequate management to conserve all species is required





High stocking density (10 sheep / ha)



Intermediate stocking density (4 sheep / ha)



Low stocking density (1 sheep / ha)

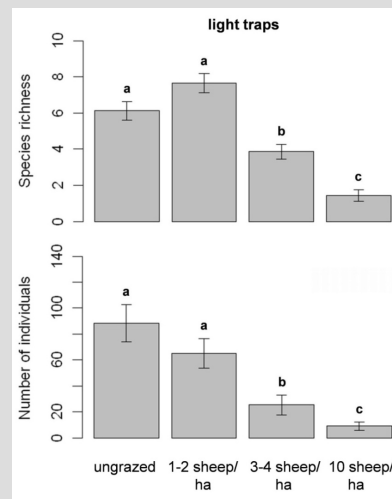


Ungrazed salt marshes (0 sheep / ha)



Moth species under different grazing regimes

- Caught with light traps and emergence traps over 2006-2009
- For details see Rickert et al. 2012 Biol. Cons.



Contrast between grazed and un-grazed salt marshes

(Long term)
un-grazed

Grazed



Pardosa purbeckensis

&

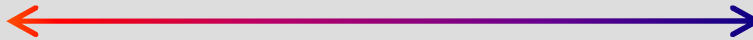


Pterostichus niger

?



Erigone longipalpis



Petillon et al 2007

Ford et al 2012

Van Klink unpublished data



university of
 groningen



High stocking density (10 sheep / ha)



Intermediate stocking density (4 sheep / ha)



Low stocking density (1 sheep / ha)

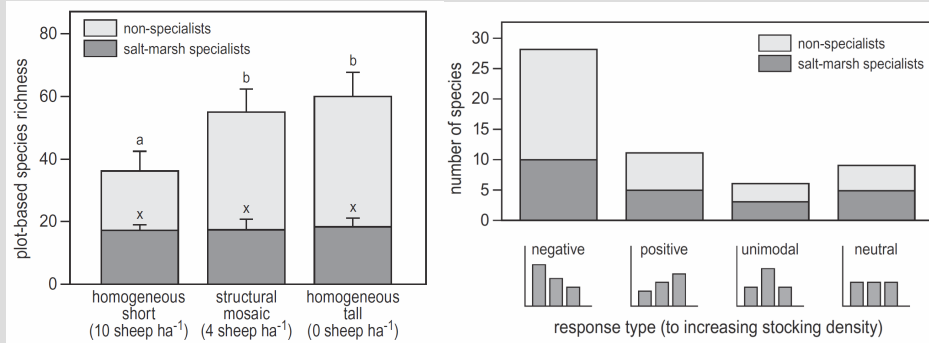


Ungrazed salt marshes (0 sheep / ha)



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Arthropods under different grazing regimes



Van Klink et al 2013 *biol cons*



Conclusions

- For herbivorous insects, vital and well-developed host plants are of high importance.
- Different microhabitats are needed to also accommodate all non-herbivorous species
- Management for the conservation of invertebrates demands vital, undamaged plants on the one hand and the (partial) suppression of late-successional species on the other hand



Management recommendations

Creation of heterogeneity is the key!

- Different management regimes in close proximity; however, more data are needed on different grazer species and densities.
- Rotational grazing to create temporal heterogeneity may prove to be effective.



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