

Functional changes in polychaete assemblages subjected to contaminants from industrial effluent discharges in Norwegian fjords

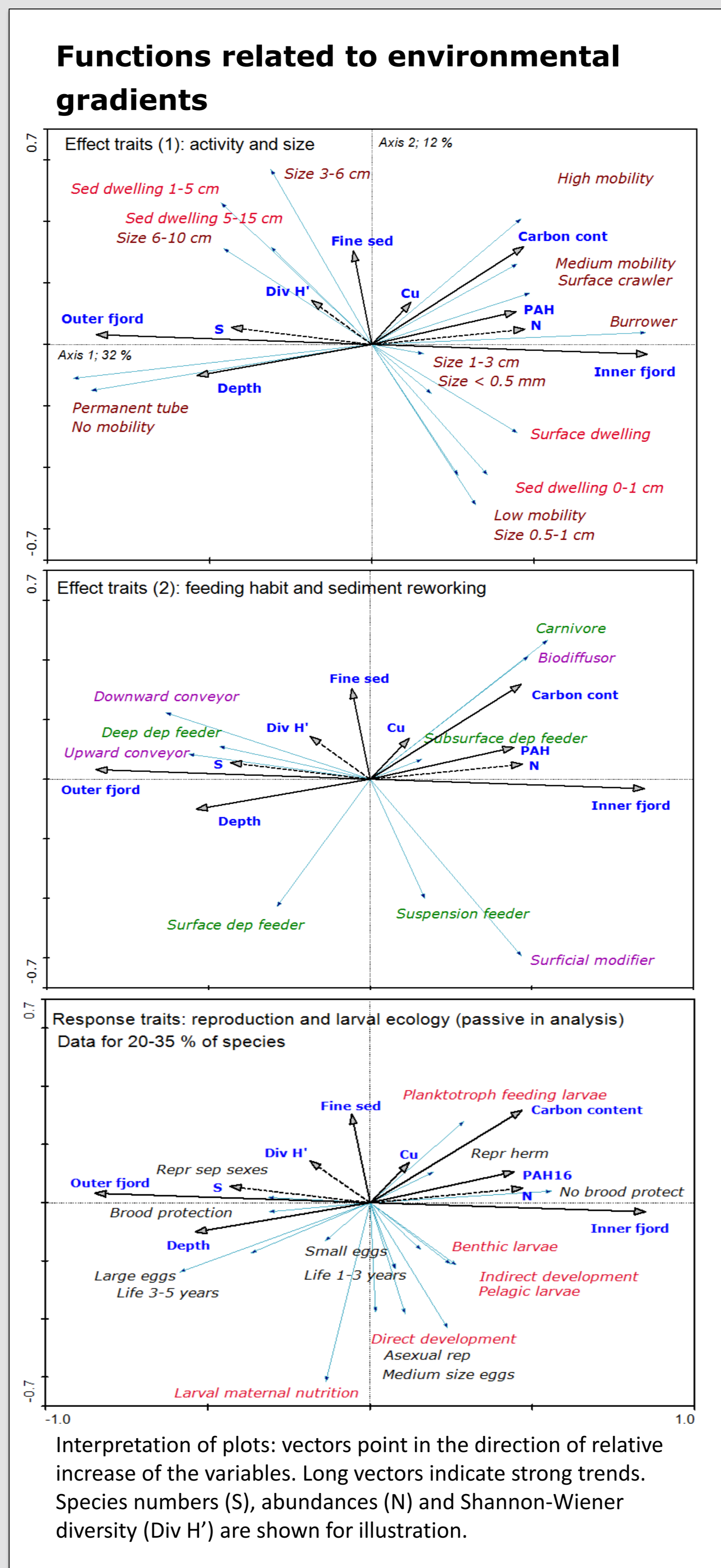
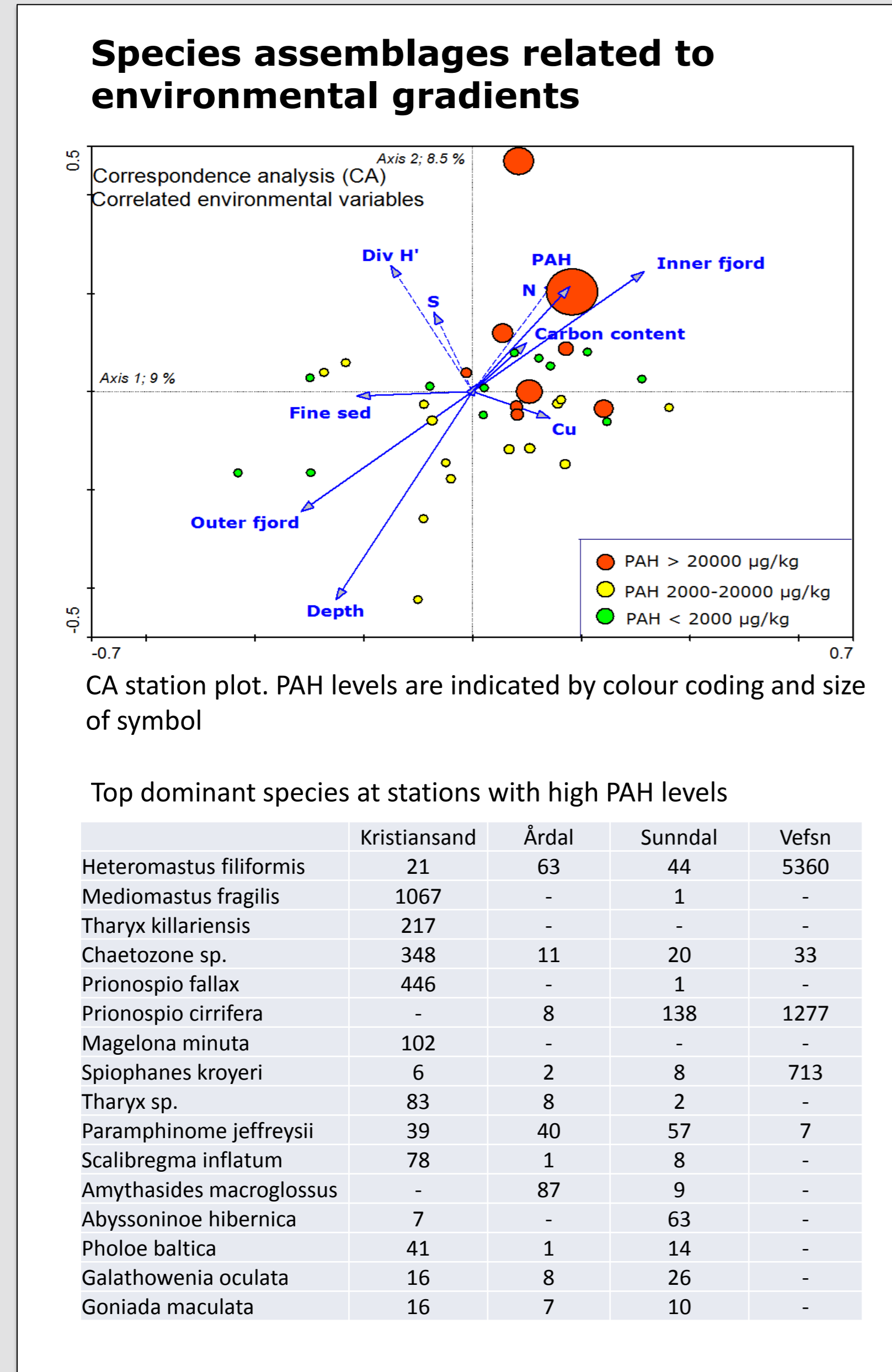
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Traits analyses are recently developed techniques to characterise and quantify the functions of species in ecosystems. One approach, 'Biological traits analysis' (BTA), combines structural data for species assemblages (species abundance or biomass) with traits information for each species to obtain quantitative expressions of ecological functioning of the species assemblages (ref 1). Traits may be classified as 'effect traits' (the species' influence on the environment) and 'response traits' (the species' adaptations to the environment).

In the present study BTA was used to examine functional changes of soft bottom polychaete assemblages in Norwegian fjords contaminated by metals and polycyclic aromatic hydrocarbons (PAHs) from smelter industry. Monitoring data from 39 stations in six fjords with PAH levels varying from background to very high concentrations were used for the analyses. In total 153 polychaete species were included.



Effect traits

From NIVA traits database

Trait	Feature / category
Adult life habit	Permanent tube
	Burrower
	Surface crawler
Adult mobility	None
	Low
	Medium
	High
Normal adult size	< 0.5 cm
	0.5-1 cm
	1-3 cm
	3-6 cm
	6-10 cm
Sediment dwelling depth	0 Surface
	0-1 cm
	1-5 cm
	5-15 cm
Feeding	Suspension
	Surface deposit
	Subsurface deposit
	Deep deposit
	Carnivore/omnivore
Sediment reworking (ref 2)	Surficial modifier
	Upward conveyer
	Downward conveyer
	Biodiffusor

Response traits

From Polytraits database (ref 3)

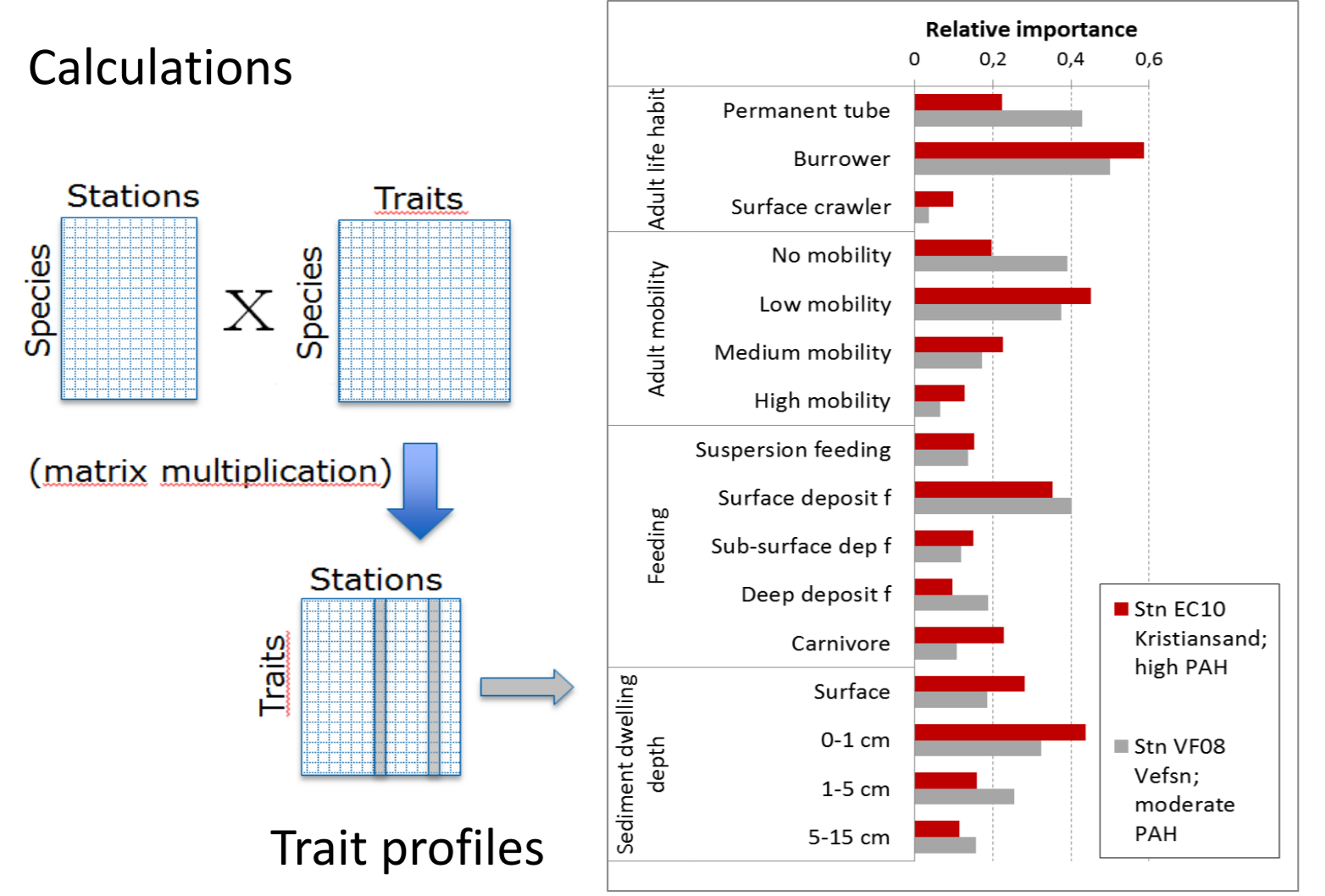
Trait	Feature / category
Life span	1-3 years
	3-5 years
Reproduction	Asexual
	Gonochoristic (sep sexes)
	Sequential hermaphrodite
Brood protection	No
	Yes
Egg size	Large (> 200 µm)
	Medium
	Small (< 100 µm)
Larval development	Direct
	Indirect
Larval mode of development	Benthic
	Pelagic
Larval feeding type	Maternally nutrition
	Planktroph

Methods

Fuzzy coding of traits

- 0 (blank) no affinity
- 1 low importance
- 2 moderately high importance
- 3 dominant

Species	Adult life habit				Mobility (relative)				Feeding habit					
	Sessile	Perm tube	Semi-perm tube	Burrower	None	Low	Medium	High	Suspension	Surf deposit	Subsurf dep	Deep deposit	Scavenger	Carnivore
Paramphinome jeffreysii			1	2			1	2						1
Antinoella sarsi														2
Harmothoe sp.			2	2			2	2						2
Phyllodoce groenlandica														3
Leitoscoloplos mammosus			1	2			2	1						3
Apistobrachius tullbergi			2	2			2	1						1
Laonice cirrata			3	3			3	3						3
Polydora caulleryi			3				2	1				1	2	
Levinisnea gracilis			3				2	1				1	2	



Functions and ecological status:

Selected traits (adult life habit, feeding, sediment reworking) and ecological status of species assemblages (stations) according to WFD classification

(1) Journal of Experimental Marine Biology and Ecology
Biological traits analyses in the study of pollution gradients and ecological functioning of marine soft bottom species assemblages in a fjord ecosystem
Eivind Oug^{1*}, Annelise Fledrum^{2,3}, Brage Rygg⁴, Frode Olsgard^{1,4,5}

(2) Ecology and Evolution
A bioturbation classification of European marine infaunal invertebrates
Ana M. Queiroz¹, Silvana N. R. Birchough², Julie Bremner³, Jasmin A. Godbold⁴, Ruth E. Parker⁵, Alicia Romero-Ramirez⁶, Henning Reiss⁵, Martin Solan⁷, Paul J. Somerfield⁸, Carl Van Colen⁹, Gert Van Hoey⁹ & Stephen Widdicombe¹

(3) Biodiversity Data Journal
Polytraits: A database on biological traits of marine polychaetes
Sarah Faulwetter^{1,2}, Vasiliki Markantonatou^{3,4}, Christina Pavlou^{5,6}, Nafsika Pappageorgiou⁷, Kleoniki Kakkiloglou⁸, Eva Chatzinkolou⁹, Evangelos Pallas⁸, Georgios Chatzigeorgiou⁸, Katerina Vasileiadou⁸, Thanos Dalakas¹, Lucia Fanni², Panayota Koulour², Christos Arvanitidis²

Concluding remarks

Mobile surface living and burrowing species increase at high PAH levels whereas tube-building non-moving species become reduced. Planktroph feeding larvae and no-brood protection increase. With regard to sediment reworking functions, that are particularly important for promoting biogeochemical cycling, biodiffusors increase whereas upward and downward conveyors decrease.

Traits that may respond specifically to PAH cannot be separated from functional changes along topographic fjord gradients based on the present field monitoring data.