Management of taxonomic species and observational data - case Baltic Sea phytoplankton

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Policy maker aims for the future

Phytoplankton occupies a central role in monitoring the state of lakes, estuaries, seas and oceans. They may be used as indicators for environmental pressures e.g. eutrophication, biodiversity and food web e.g. quality and availability as well as justification for economically significant decisions like closing fisheries due to toxic plankton. Good taxonomical knowledge is a prerequisite for successful and meaningful monitoring.

Researcher finds the connections

For a proper scientific study all of observations, irrespective which were the taxa definitions used when the observation saved for the first time, should be brought out according to the current specieslist. Sometimes going far back in time, actually reduction of the data sets to their least common denominator, may be required.

IT provides the technology

For database systems the management of taxonomy is a demanding and interesting challenge. The system we developed is able to trace changes in the taxonomy and at the same time save the original information of the observations. The user gets the information even for long time series in a uniform format, so that possible changes in the taxonomical information are correctly taken into account. We defined 6 operations to handle all changes and developed a worksheet for the specieslist update procedure.

Taxonomist offer the tools

Crucial for research and monitoring is the management of taxonomy and the mutual understanding of species concepts and definitions, i.e. that everybody gives the same species the same name. The phytoplankton taxonomists community around the Baltic Sea was aware of the essence of common species lists. Several actions have been taken since 1970's e.g. RUBIN code (late 1980's) and G. Hällfors' Checklist (2004) for HELCOM. In 1991 HELCOM's Phytoplankton Expert Group (PEG) was established with the main aim of standardizing methods of collection, counting and identification of phytoplankton species in the Baltic Sea.
During annual meetings of PEG common phytoplankton species and volume lists were agreed upon and compiled based on the lists already in use at the different laboratories participating in monitoring and intercalibration of procedures and taxonomic knowledge.

UPDATE:	update non-key value attributes of a taxon
INSERT:	insert a new species e.g. a taxon with a new combination of keyvalues
FOLLOW:	form a new taxon by changing some of the keyvalues of an existing one
MERGE:	merge two taxa into one
BRANCH:	split a taxon into two different taxa e.g. combinations of keyvalues
DETACH:	relax the definition of a taxon so that the same combination of keyvalues may be used late by another taxon

EXAMPLES:

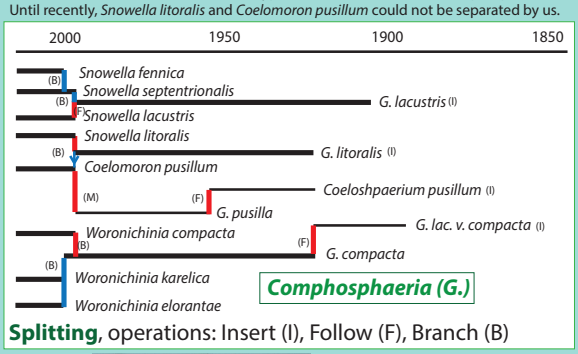
A close co-operation with a taxonomist and a data manager is essential for success. PEG has a common counting program with spelies list for laboratories and we developed an easy procedure to update the specieslistdata with an excel sheet.

Date	Operation	old_systcode	old_genus	old_species	old_subno	old_troy	old_size	systcode	genus	species	subname	troy	size	counting_unit	size_description	geometric_sh	lenght	width	height	diameter	nr_cells	filament length	volume	carbon	Checklist	PEG	Brackish_water_ITIS	auctor
2010-05-14	follow	100540	Nodularia	baltica		A		100540	Nodularia	baltica		A	1	filament	6x100µm	Cylinder	100	6	100	6	25	4	2830	458,10	x	x	x	
2010-05-14	update	100540	Nodularia	spp.		A	2	100540	Nodularia	spp.		A	2	filament	6–8x100µm	Cylinder	100	7	100	7	33	3	3850	622,44	x	x	x	
2010-05-14	merge	100540	Nodularia	spumigena		A		100540	Nodularia	spumigena		A	3	filament	10–12x100µm	Cylinder	100	11	100	11	1	4	9500	1428,27	x	x	x	Mertens ex Bornet & Flahault 1886
2010-05-14	follow	100540	Nodularia	spumigena		A	4	100540	Nodularia	spumigena		A	21	filament	6–8x196µm	Cylinder	196	7	196	7	1	6	7540	1121,60	x		x	Mertens ex Bornet & Flahault 1886
2010-05-14	detach							100540	Nodularia	spumigena		A	4	filament	15x100µm	Cylinder	100	15	100	15	1	4	17663	2556,95	x	x	x	Mertens ex Bornet & Flahault 1886
2010-05-14	follow	250540	Scrippsiella	malmogiense		A		250540	Scrippsiella	malmogiense		A	1	cell											x		x	
2010-05-14	insert							250540	Scrippsiella	spp.		A	1	cell	15x17µm	Cone+half s	17	15	17	15	1		1442	199,86	x	x	x	(Schiller) Larsen in Larsen et al. 1995
2010-05-14	follow	659005	Scrippsiella	hangoei	cyst	A		659005	Scrippsiella	hangoei	cyst	A	1	cell	18–20	Sphere	19	19		19	1		3590	470,64	x	x	x	(Schiller) Larsen in Larsen et al. 1995
2010-05-14	merge	250540	Scrippsiella	cyst		A	2	659005	Scrippsiella	hangoei	cyst	A	1	cell	18–20	Sphere	19	19		19	1		3590	470,64	x	x	x	(Schiller) Larsen in Larsen et al. 1995

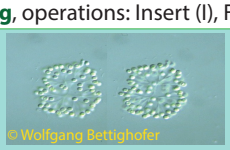
Operation — Old key values — New key values — Non key attributes

The definition of species and specieslists may change when sampling amd analysis methods improve, alien species apear, new species are found and name aliases are discovered. Here we represend three species with different histories. In the pictures the vertical lines show the fate of a name from the description of a taxon to the present. Thick lines indicate the names which have mainly been used. Horizontal red lines indicate that a name has become a synonym, blue lines where splitting has occurred. *Arrows* indicate confusion or transfer of misplaced parts of a taxon.

The small-celled species of the genus *Comphosphaeria* originally were only a handful. In 1988-1992 a number of new species described and redistributed in the genera *Snowella* and *Woronichinia*. A different type of colonies remained in *Gomphosphaeria*. Until recently, *Snowella litoralis* and *Coelomoron pusillum* could not be separated by us.



Splitting, operations: Insert (I), Follow (F), Branch (B)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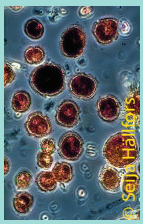
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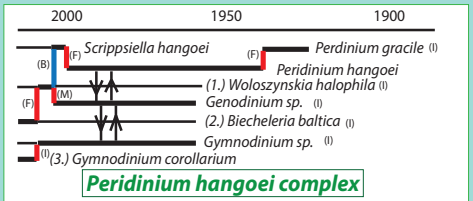
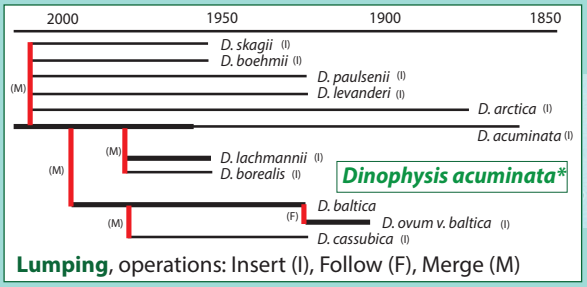
The springblooming *Scrippsiella hangoei complex* comprises three closely similar types of cells which are difficult to separate in the light microscope. Through cultures and electron microscopy three different species have been sorted out. The arrow towards *(1.)* indicates that resting spores were initially allocated to the wrong species.

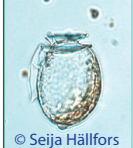


Rearranging, operations: Insert (I), Follow (F), Branch (B), Merge (M)

The morphologically highly variable species *Dinophysis acuminata* has been described several times under different names. Ribosomal nucleic acid sequences, however, show little variability in this part of the genus. Therefore, sequencing is not decisive for the taxonomy. The large morphological variability indicates that this is one collective species.



Lumping, operations: Insert (I), Follow (F), Merge (M)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