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Background

The LiACAT tool has been developed to support the collection of literature information on the impacts of pressures on ecosystem components (see for example Outcome HOLAS II TAPAS Pressure Index WS 2-2016, paras 42-45).

This document contains a summary of the most relevant features of the tool and a manual for data input, in order to increase transparency about its functions and encourage its wider use.

Action requested

The Meeting is invited to take note of the information.

Literature based Analysis and Cumulative Assessment Tool - LiACAT

LiACAT is an online tool facilitating sorting, filtering and analysing selected literature data. It can handle complex relationships, interaction effects can be visualised effectively and different data analyses will be possible in the near future. Traceability back to the literature source is possible from any process step, which allows a very high transparency. The tool has been developed within a project funded by the German Environment Agency for the assessment of cumulative effects of anthropogenic pressures acting on the marine environment. However, some basic features of the tool have already been developed earlier for the mybiOSis environment (a data portal for biodiversity observations linked now to the Romanian NGO myNature Association) in which LiACAT is embedded. The tool can be applied also for other topics dealing with pathways and interaction effects and is not restricted to the application for the MSFD and the marine environment.

In the following, the most relevant modules and functions will be presented including also those, which are still under development.

Literature data input form

For entering literature information describing what a publication is about in general, a special literature input form is used. Text input fields and checkboxes for relevant aspects of the theme of interest have been implemented for anthropogenic effects on ecosystem components but could be modified for other topics. Input fields for bibliographic data are fixed though. The bibliographic data may be entered either manually into the system by typing information into the respective fields, or automatically by importing the reference details from standard citation files, which saves a lot of time (Figure 1). The following citation file types may be imported: RIS - Research Information Systems, EDW – EndNote, CIW - ISI Thomson, and BibTex files. In the data input form, the user can switch between bibliographic information typically needed for scientific articles, books and chapters. The entry fields will adapt automatically based on the user's choice under the field reference type. The reference information may be displayed not only in a tabular form together with different references belonging to the same project, but also as one summary document specifically for this publication called 'reference details'. The reference details window is interlinked throughout the LiACAT tool connecting to other data input forms related to the assessment procedures.

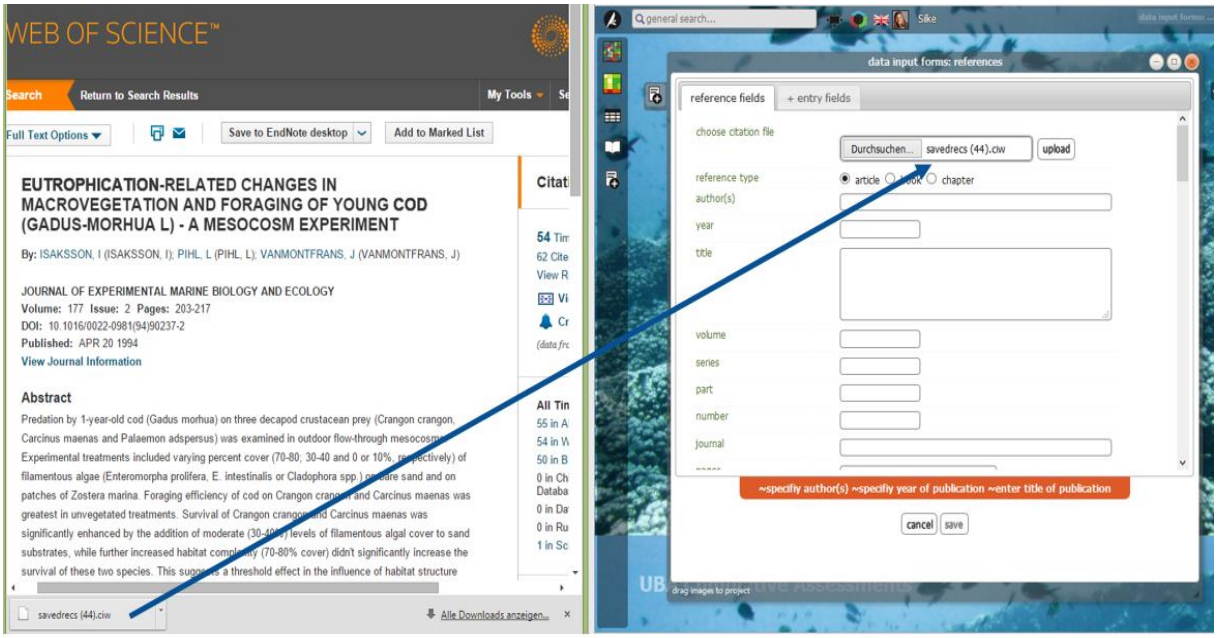

Figure 1 Literature input form

Tagging references

For an efficient analysis of literature data, LiACAT offers several features to classify and filter the data records. This enables the user to create subsets of the entered references related to special topics. For that purpose, each reference can be tagged appropriately, using a set of standardized tags. This will be done in the reference details window by switching to the tab tags (Figure 2). In order to provide a standardized set of tags to be consistently used by all members of a project within mybiOSis environment, the tags may be organized in the form of a classification tree. This classification tree is very important to allow later filtering of the data, so that one can perform the analyses only with a subset of the literature analysis. In this context, it should also be noted that inside the reference details is also an input form for specifying the species, which are considered the reference, allowing later on the application of a species filter in the assessment toolkit as well.

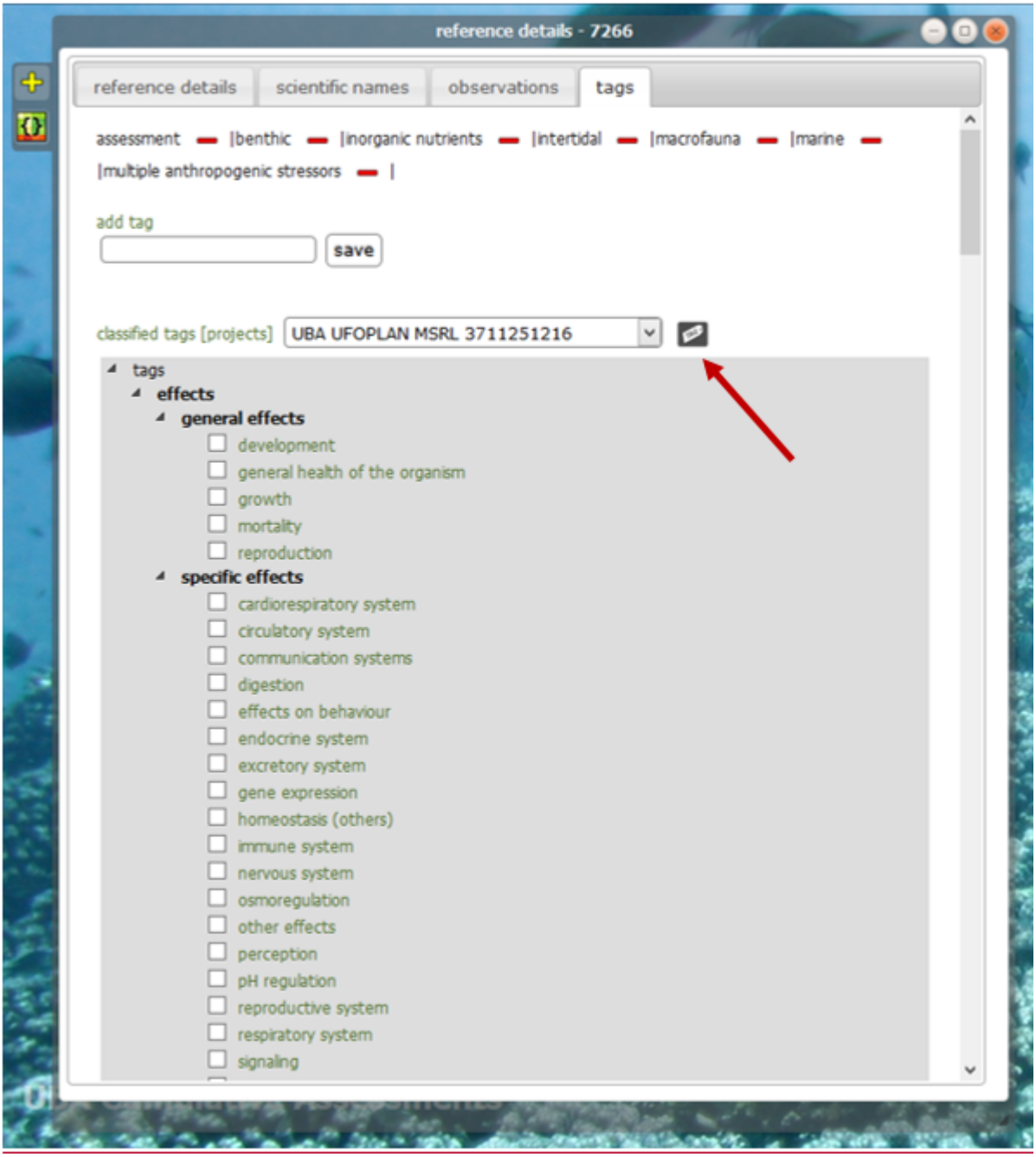

Figure 2 Setting tags for filtering literature

Relationships editor and graph editor

Data about relationships can be complex and involve different types of data, which cannot be handled anymore by a tabular spreadsheet or simple input form. Therefore, the module 'relationships editor' has been developed (Figure 3). Here, information about the pathways, the environmental or laboratory conditions under which the relationship was observed can be added. Not only single relationships, but also relationship groups involving several sources or targets (proxies for defining the direction of the relationship) can be entered.

Moreover, species names, statistical data, information about the nature of cumulative effects such as synergistic effects as well as notes can be added for each single relationship and will be aligned to it. With a graphical tool, the user can add more information about a relationship (-group) via drawing

lines between the environs forming a relationship and using plus and minus signs for indicating increases and decreases of the environs (Figure 4). The lines can also be highlighted if a certain effect and thus the corresponding relationship is rather positive or negative for the environment (or if it is hard to judge).

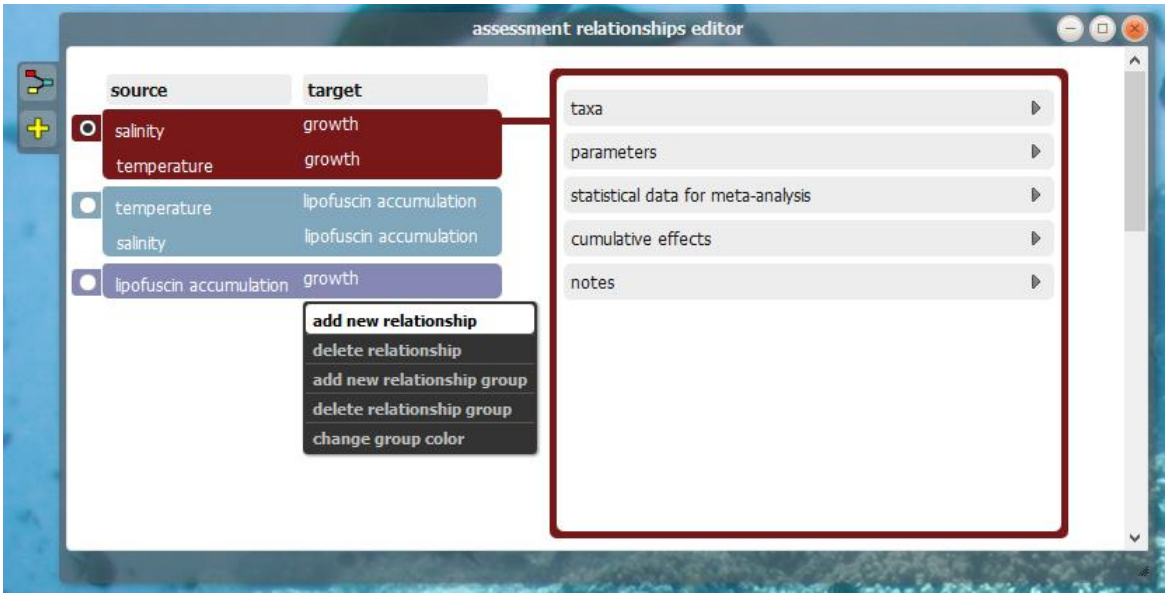

Figure 3 Defining relationships in the 'relationships editor'

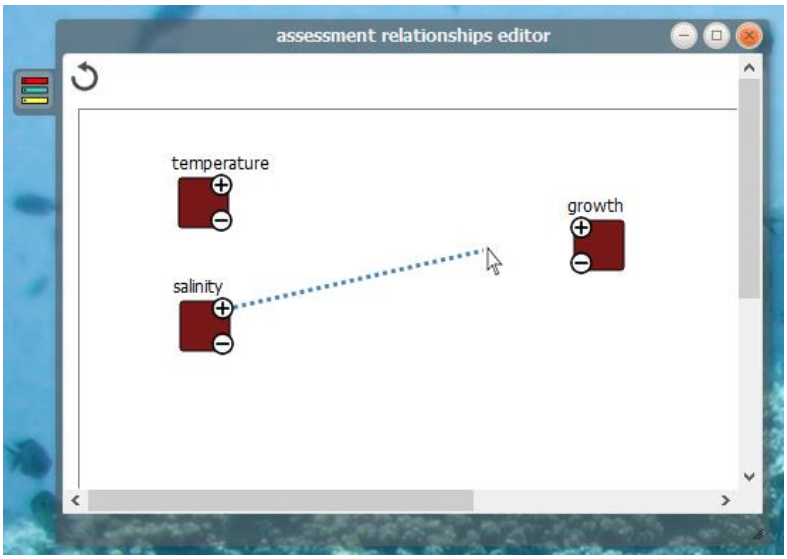

Figure 4 Adding additional information in the 'relationships editor'

WebPlotDigitizer, datasets and sheets for relationship data

If the publication contains quantitative data, which are shown in graphs, these can be extracted with an integrated freeware tool, the WebPlotDigitizer (http://arohatgi.info/WebPlotDigitizer/) (Figure 5). The data will be saved as datasets in a tabular form, which are editable. Links to these datasets will be added to the reference details. Datasets from different publications can be merged together in a sheet so that later analyses can be based on these merged data. These modules (WebplotDigitizer, datasets and sheets) will be moved soon to the relationships data and be aligned with these so that the information can be found more easily.

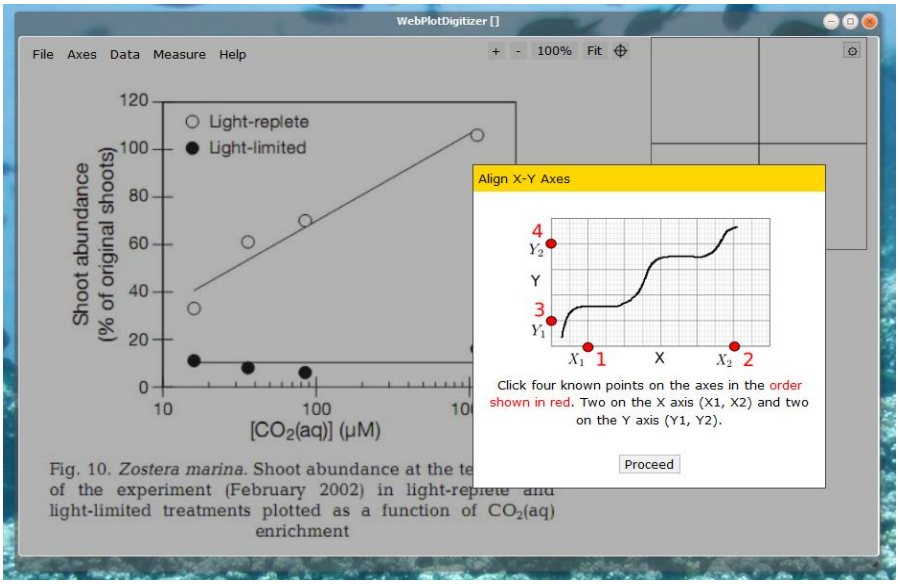

Figure 5 Screenshot of the integrated WebPlotDigitizer in LiACAT

Assessment Toolkit

In the assessment toolkit, a so-called 'scene' can be created. This means that all the literature collected for a certain project will be filtered for certain aspects defined in the classification tree structure and the corresponding tags, the species of interest and the relationships/relationship groups of interest. The linkages between the different environs as well as some information about the relationships will be visualised in a Sankey diagram showing the pathways associated with certain selected effects (Figure 6). The visualisation will support the user in getting a better understanding of the system.

As these networks can be quite complex, a feature has been developed to group single, precisely defined environs to bigger groups. A new visualisation option has been included (Figure 8 and Figure 9), which allows switching between different levels of detail for the final diagram. This visualisation works interactively and a click on a group name representing several environs will then show a more refined picture displaying all single environs together with their relationships. Moreover, information about the nature of the relationships will become visible when hovering the mouse cursor over a link between two environs (this function is still under development). It is further planned to combine the Sankey diagram with a mathematical model, so that calculations for estimating the strength of an impact expected from predefined pressure intensities can be performed online.

The assessment toolkit also comprises the option to create a matrix. The building blocks of the matrix will automatically be created based on the filter selections. The user then needs to add information about tolerance levels for pressures, optimum values and pressure intensities as well as an interaction factor in case of interaction effects. These data, which can be derived from literature information, will be used for the calculation of a cumulative index. The index indicates whether the combination of pressures is expected to act in concert rather synergistic (more severe effect of the pressures acting in combination than the expected effect of the single pressures alone without the consideration of any interactive effects) or antagonistic (less severe effect than expected).

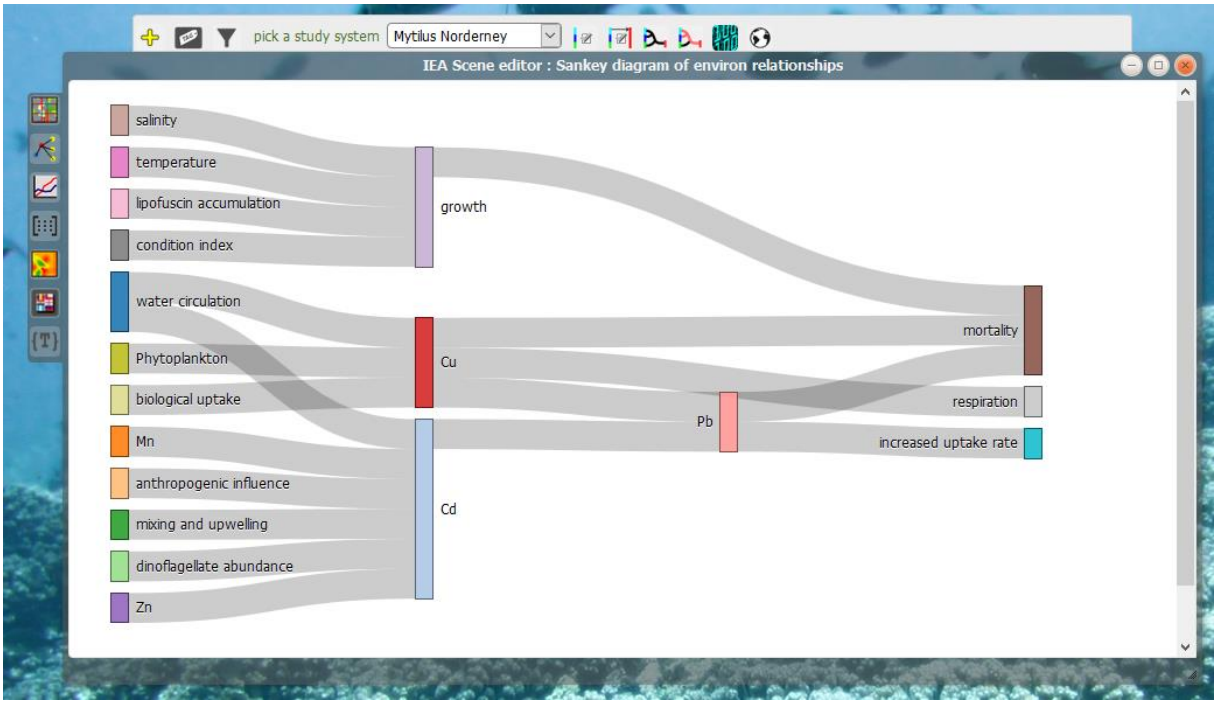

Figure 6 Sankey diagram - option 1

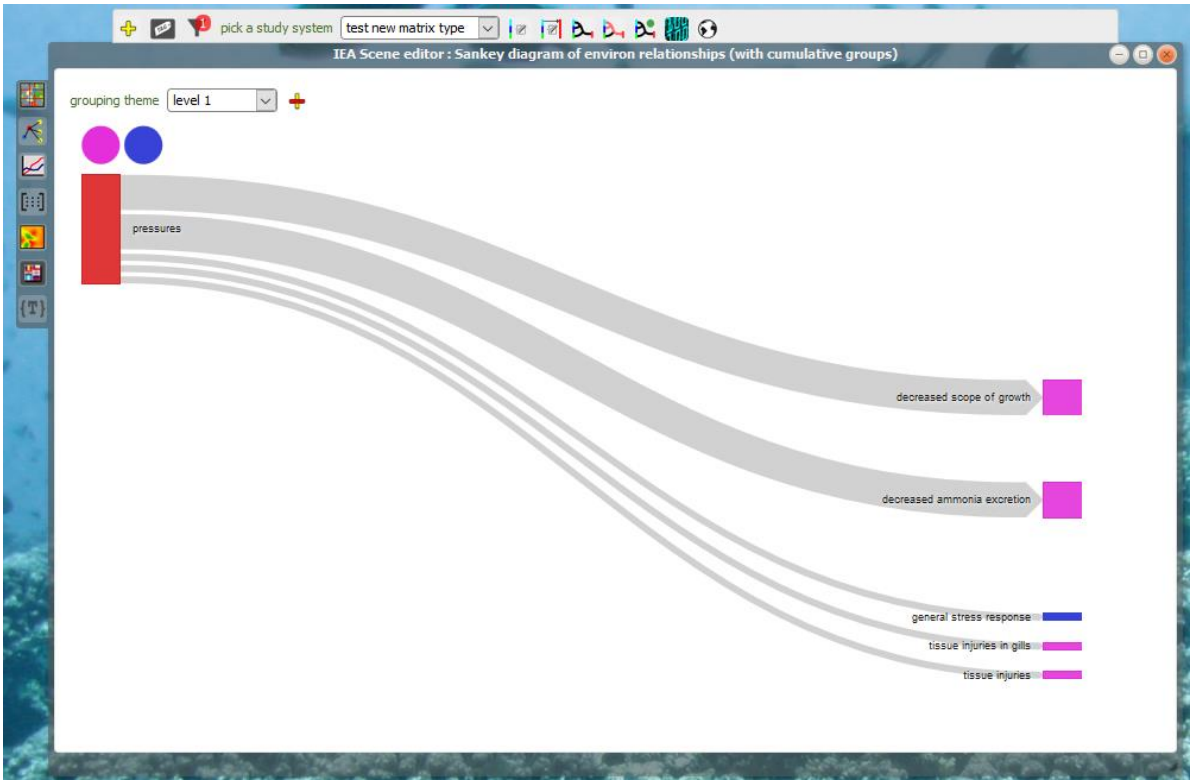

Figure 7 New Sankey diagram - option 2 – simple example with two topics expanded for viewing the details

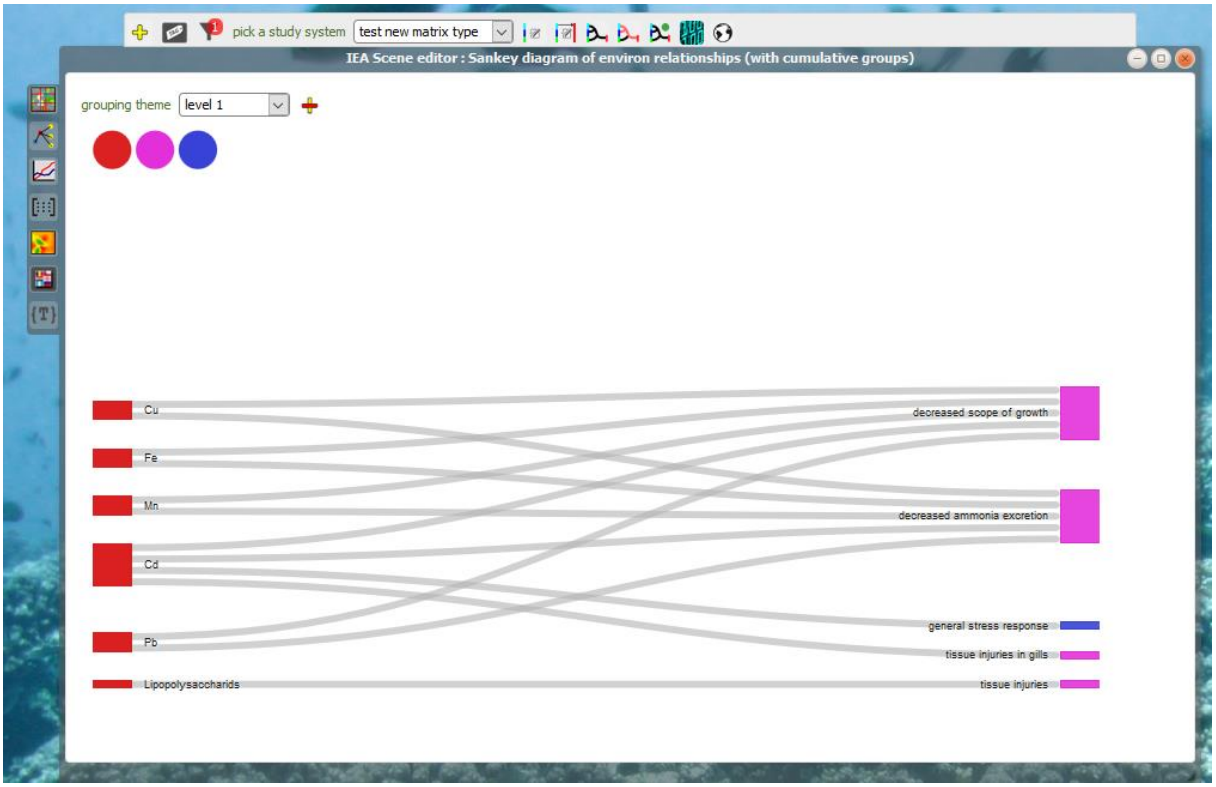

Figure 8 New Sankey diagram - option 2 – simple example with all topics expanded for viewing the details

Assessment grid calculations and environmental datasets

The LiACAT tool may be used for managing environmental data collected by monitoring stations. It can be used for assembling datasets and geographical grid files that may be applied within the assessment procedures. For a dataset, the user can define the time period as well as the geographical range. Simple calculations with the data such as counting the number of available datasets or calculating the average of a dataset can be performed. Data may be interpolated for building geographic grid files, while the confidence in the data can be indicated by choosing the option to show the monitoring stations on raster maps. It is planned that this module will be further developed so that more calculations can be done and direct links to the assessment results can be set. Geographical data can be plotted and be shown in a map as point data as well as polygons (Figure 9).

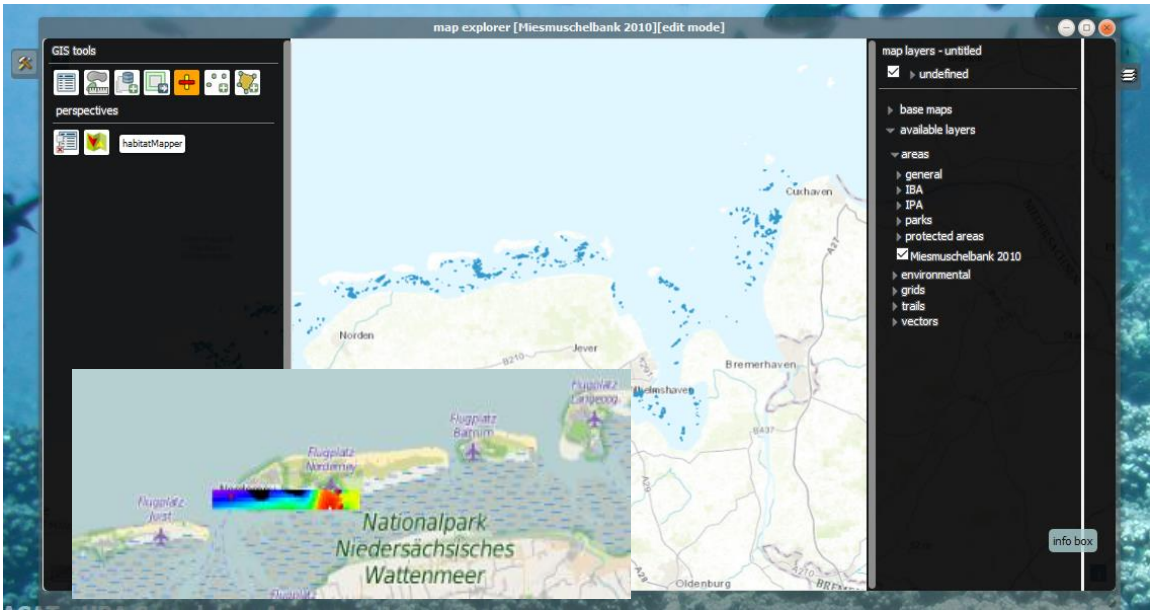

Figure 9 Map explorer and visualisation of interpolated data

Additional notes

Project affiliations and data sharing can be handled in the mybiOSis environment. Furthermore, the platform is hosting very different projects, which are all related to the broader topic biodiversity. This offers the potential opportunity to combine different features from other projects of interest.

Manual for literature input - LiACAT (Literature based Analysis and Cumulative Assessment Tool)

Getting started

Open the mybiOSis homepage: http://mybiosis.info. By clicking on the button 'About' down to the left (Figure 10), you will find some general information about the homepage itself as well as links to the different projects. You will also get an overview over the different possibilities, the scope, and applications of mybiOSis. Under 'Projects', you will find for example 'UBA UFOPLAN Litter 371325220', 'UBA UFOPLAN MSRL 3811251216' and 'Impacts on biodiversity in the Baltic Sea'.

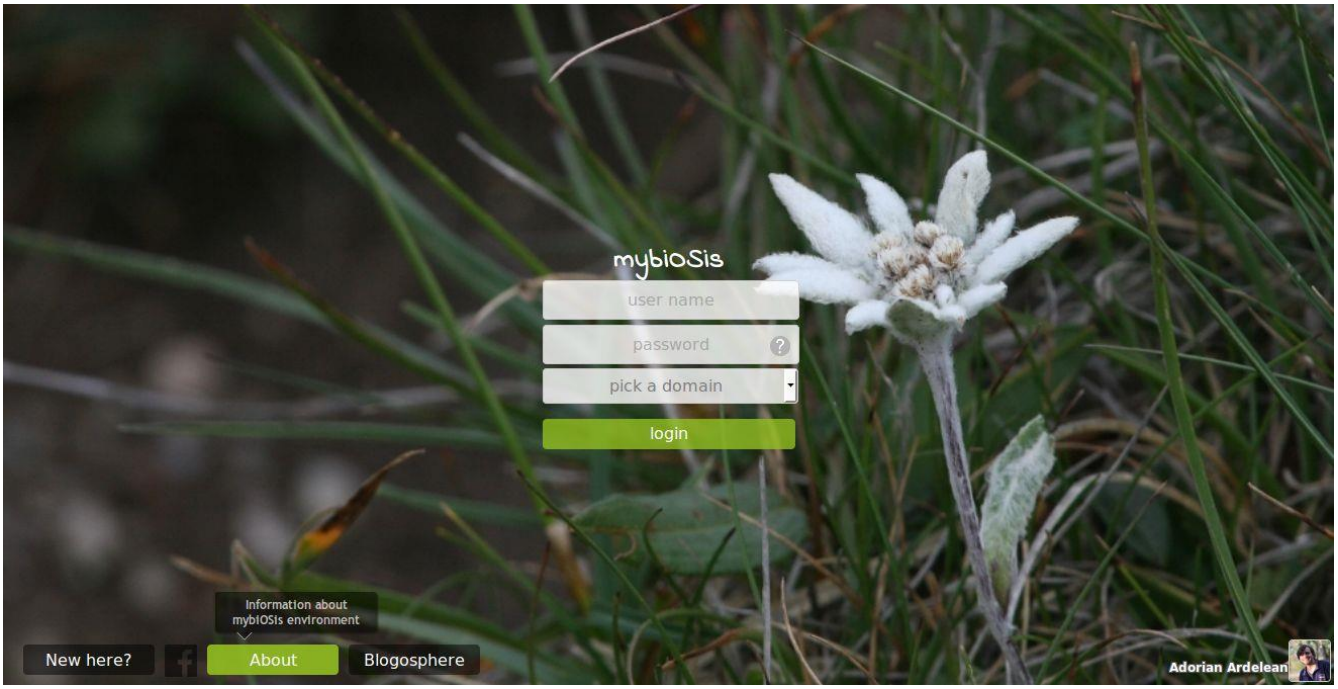

Figure 10: Home page of mybiOSis

In order to get access to the system, please, go back to the first page and click on the button 'New here?' down to the left: You will be directed to a registration form, where you can fill in your personal data and choose a password. Please, note that the password should contain at least eight characters, which at least should include an upper case letter and a number. Alternatively, you can log in with your Facebook account in case you have one.

General information on the interface

The interface of mybiOSis emulates well-known desktop operating systems. Its main screen includes a menu on the left (Figure 11, arrow 1), a taskbar at the top (arrow 2), and a 'desktop' surface (arrow 3). On the right side of screen, there is an activity panel where you will get a preview of user activity within the system (arrow 4). This panel may be hidden at any time. Applications developed to run within the mybiOSis environment generally load inside rectangular areas that emulate desktop-like windows (arrow 5). The windows may be dragged and

resized, and can be individually minimized, maximized, or closed. Each window has a corresponding button in the taskbar (arrow 6). By clicking on one of these buttons, a window may be enlarged and set to visible on top of other windows. A window may have a vertical toolbar on its left side (arrow 7). The toolbar usually contains icon-buttons with additional functions related to the application loaded inside a window.

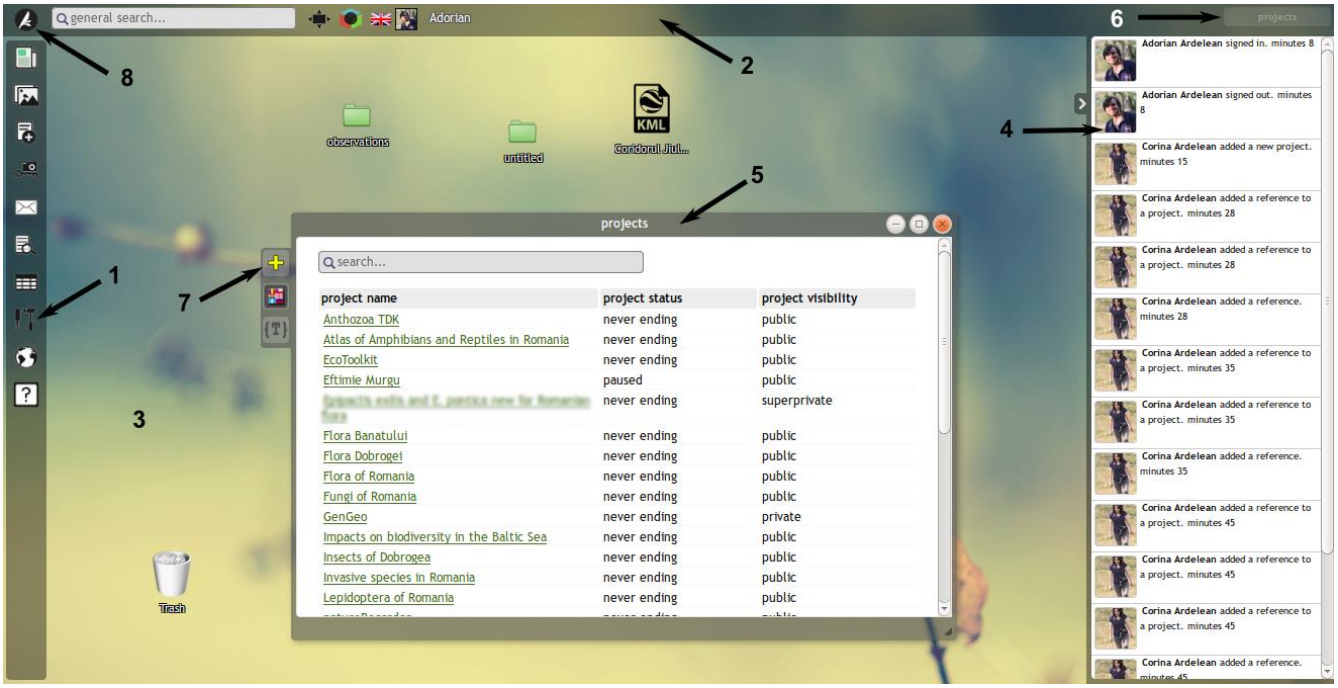

Figure 11: Desktop of mybiOSis biodiversity view

The taskbar at the top of the screen contains links to a set of generally applicable functions, as well as buttons for rapidly accessing windows opened on the screen. By clicking on the *Application directory* icon (the first icon on taskbar, Figure 11, arrow 8), a screen that contains a list of all applications available to the current profile is opened (Figure 12). This list will be continuously updated with new applications.

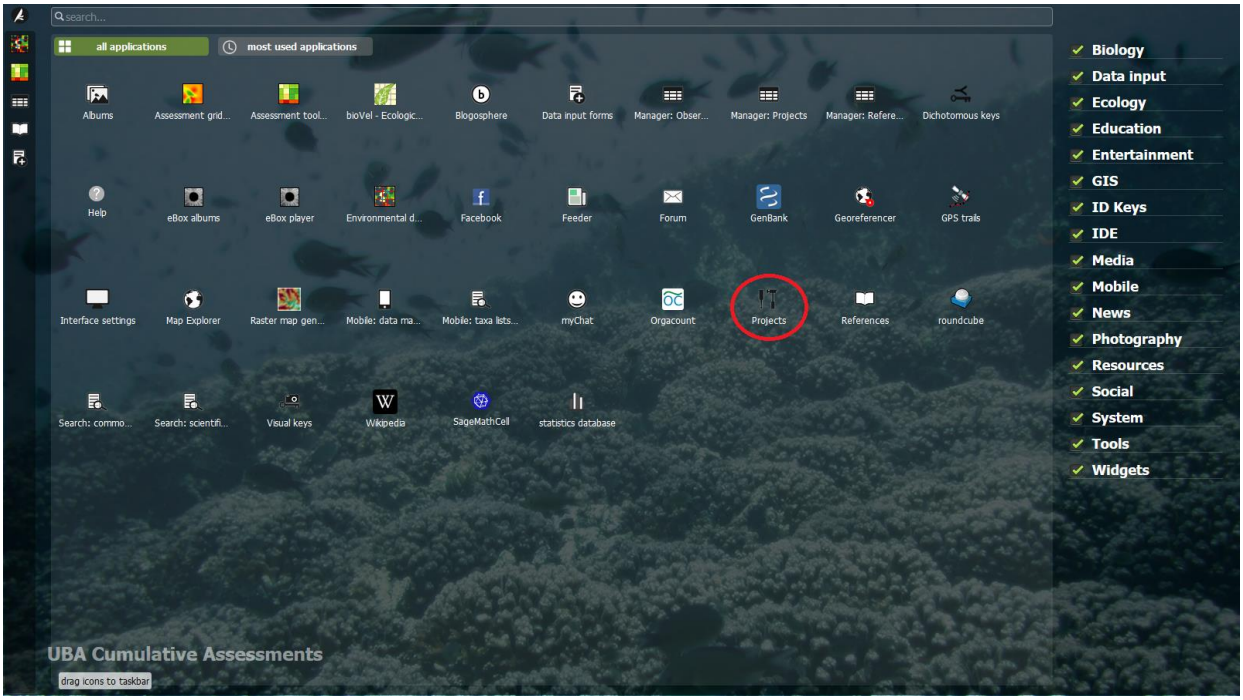

Figure 12: Overview of the applications directory on mybiOSis

By clicking again on the *Applications directory* icon the previous screen will be loaded.

On the taskbar, there is also an input box for general searches within the mybiOSis database. For an example, type *Mytilus* and press the enter key: the general search function will return counts and links to various programs that include digital objects (images, name citations, references etc.) matching the searched term. You can use the same box for searching references by their identifier (reference number): for example, type 'r8186' and then hit the enter key – the reference detail window will open with information associated to the searched reference number. Next to the general search box there are two icons for changing the size of the browser to a full screen size as well as to links to alternative profiles of interface (in mybiOSis these are called *views*; they will be referred to below). Additionally, to the right side of the general search box you will see your user icon and a label with your first name: a click on it would open a menu with access to your profile and the logout function.

Application directory opens a screen with applications available for the current view.

Full screen enlarges the browser window to full size of your computer screen.

Change view allows switching among various mybiOSis views (currently only *Biodiversity* and *Water quality assessment toolkit*).

More information about the mybiOSis environment can be found at https://kladia.info/docs/index.php?title=enviornment.

Projects

In order to be able to use the LiACAT applications, you have to be a member of an associated project (more about mybiOSis Projects at https://kladia.info/docs/index.php?title=projects). To access the list of projects from mybiOSis environment, click on the icon of the application *Projects* in the menu on the left side of the screen. If the *Projects* icon is not available in the menu, click on the A*pplication directory* icon and localize the *Projects* application within the applications list (Figure 12).

In the window, which opens after clicking the icon *Projects*, a list of accessible projects will be displayed. By clicking on the name of a project, an additional window with details of the selected project opens. The information is organized in tabs and may include a general description of the project, associated images, albums, and statistics. To join a project, open the *project members* tab and click on the button *join project* for becoming a new member (Figure 13). You can also get an invitation to join projects by your mybiOSis friends or invite friends yourself. The administrators of the project will receive a notification on your request and you will get access to the project related tools. Meanwhile, your request to join will be labelled appropriately in the list of members of the project.

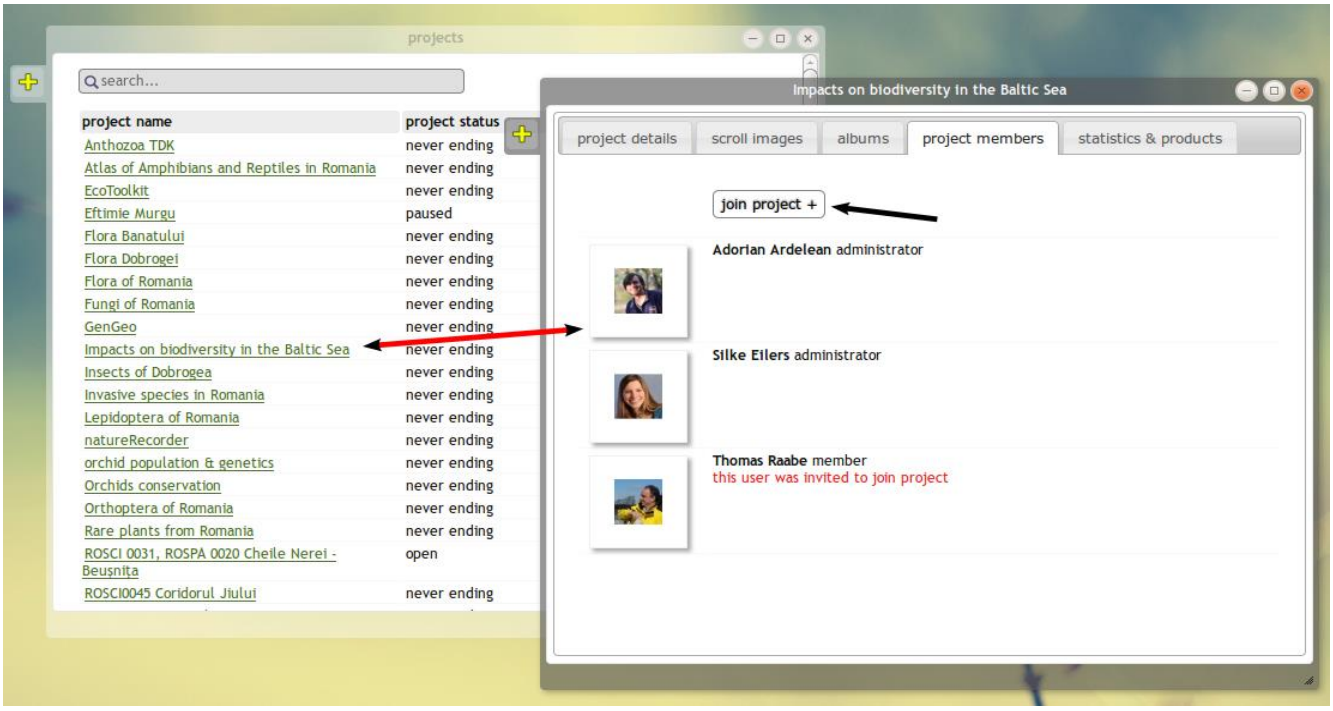

Figure 13: Screenshot showing how to join a project

Once you have joined the project, you may pick a domain of interest at the login (currently there are two available views: 'Biodiversity' and 'Water Quality

Assessment Toolkit'). For accessing LiACAT, please, use the Water Quality Assessment Toolkit domain (Figure 14).

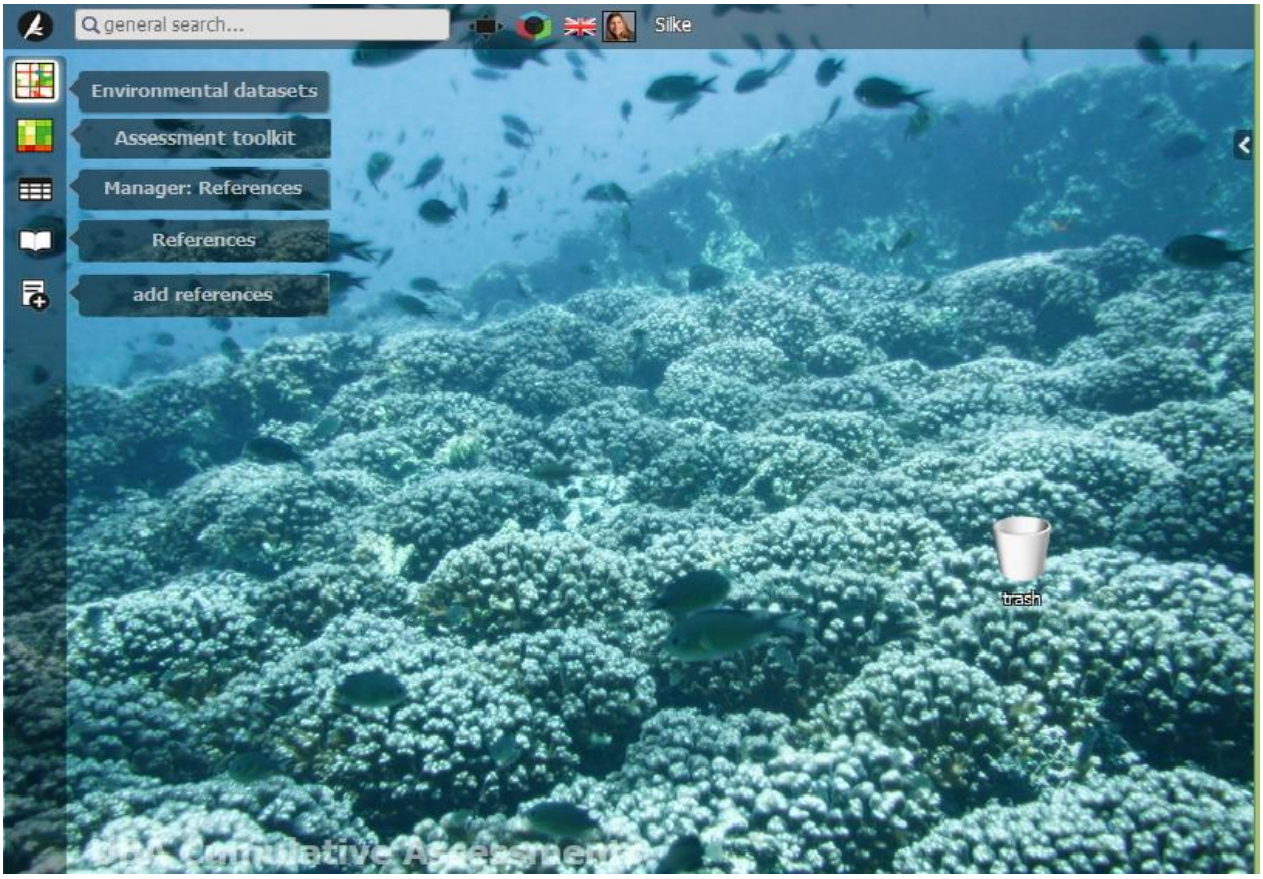

Figure 14: Overview of the most important applications for the LiACAT Tool

Please, find below a list of main applications that you will probably use while working on the project:

Environmental datasets: an application for getting an overview over uploaded monitoring data.

Assessment toolkit: an application for conducting cumulative effects assessments.

Reference Manager: an application that builds a searchable spreadsheet-like table of all literature data associated to projects.

References: an application for searching references stored in database.

Data input form: an application for entering literature specific data.

Projects: an application for management of projects.

If you like to use frequently also other applications, just click on the *Applications directory* icon and drag & drop the icons of the desired applications from the list of applications to the menu on the left side of the screen (Figure 12). You can also change the order of icons in the menu. These settings will be saved automatically for your next mybiOSis/LiACAT sessions.

Data input

Bibliographic data can either manually be entered into the system by typing information into the respective fields, or automatically by importing the reference details from standard citation files. For entering new references, click on the *add references* icon in the menu on the left side of the screen. This will open the data input form for references.

To import the data using citation files, first save the citation file as a full record from the bibliographic resources (usually literature databases such as WebofScience, Google Scholar or Journal pages) in a folder on your computer. In Google Chrome, the downloaded file of a citation file will appear at the bottom of the browsing window immediately after saving. Drag the file from its location and drop it inside the reference entry form into the field right next to *choose citation file* and then click on the upload button (Figure 15). The information included in the citation file will be automatically filled into the *data input form*.

If all mandatory bibliographic data are entered, a green bar will appear at the bottom of the *data input form*, indicating that the reference is ready to be saved to database. The following citation file types may be imported: RIS - Research Information Systems, EDW – EndNote, CIW - ISI Thomson, and BibTex files. Please, note that some bibliographic resources do not format files appropriately; please send us examples of files that will not work for import, including also the source of the file. Citations files may be stored on your computer and imported into the database at any time.

Alternatively, data can be entered manually into the *data input form*. Again, when all mandatory data is provided, the feedback bar at bottom of form will become green, indicating that the record may be saved in the database. Otherwise, the feedback bar will be red, if information on mandatory fields is still missing.

In the *data input form* one can switch between bibliographic information typically needed for scientific articles, books and chapters. The entry fields will adapt automatically based on your choice under the field *reference type*. Other reference types may be adapted in the future.

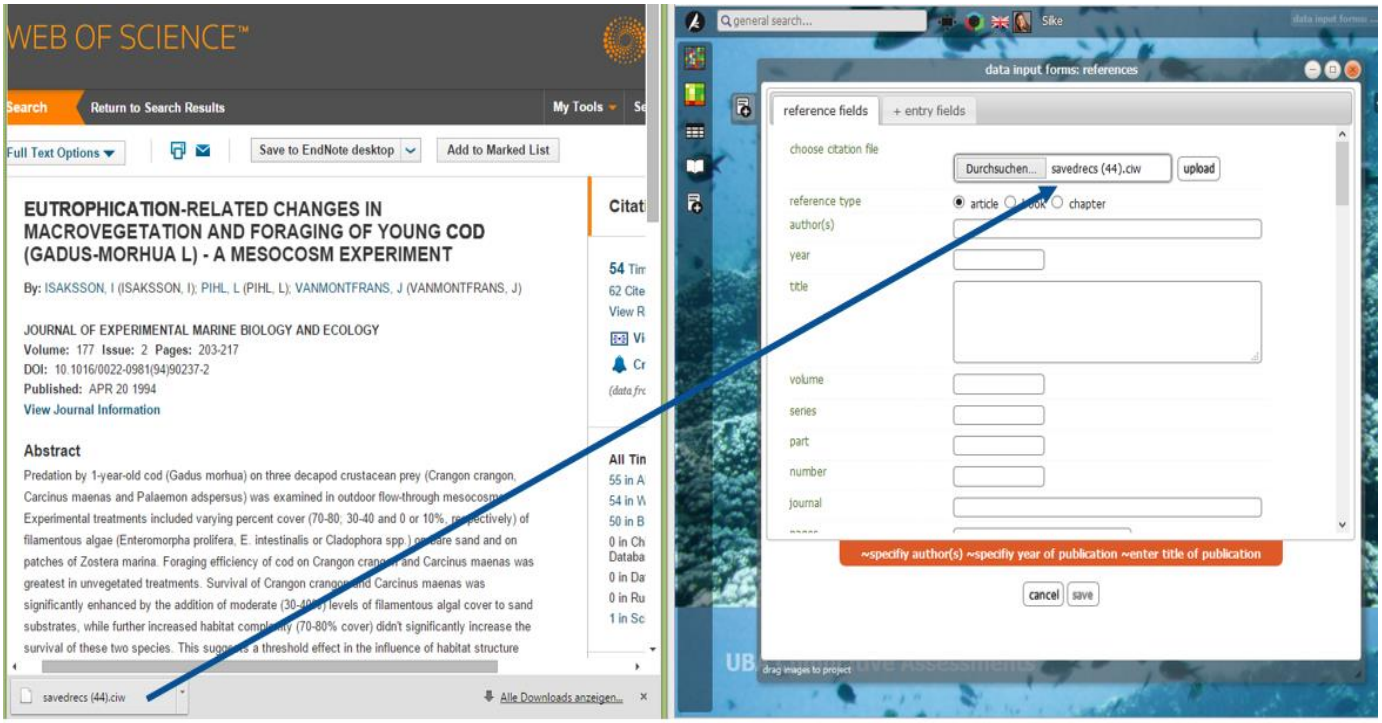

Figure 15: Data input form – entering bibliographic information

In the same form, content related information can be entered manually (Figure 16). Within the references data input window, under the tab *reference fields*, you will initially find a set of input fields that are generic for inputting bibliographic data. A selection of available optional entry fields for relevant topics related to anthropogenic pressures on ecosystem components and on communities and habitats can be found under the tab *+entry fields*. This list can be used to customize the reference entry form for individual needs: you can checkmark the fields, which are relevant for your topic and they would immediately become available inside the data entry form in reference fields tab. To remove a field from the input form, uncheck the respective field inside tab *+entry fields*. Alternatively, you may adjust the form settings by using the optional field settings under *reference fields* tab. For accessing the settings of an optional field, place the mouse on top of an optional field for about two seconds: a set of icons would show up on right side of the input box (Figure 16). The red minus icon can be used to remove the field from the form. The rest of icons can be toggled between two statuses:

- *carry on values* would populate the field automatically with the value of last entered record;
- the field *visibility* will set if information stored in the field is visible to other users;
- the *pin* field will determine if a field will be included next time when the entry form will be opened.

It is recommended to make only the bibliographic information visible and to hide all other information.

Carry on values off: values of this field will not be inherited from one record to next.

Carry on value on: values of this field will be inherited from one record to next.

Field will be visible to other users.

Field will not visible to other users.

Filed unpinned, it will not be included in form next time you enter data

Field pinned, it will be included in form next time you enter data.

Remove field from data entry form.

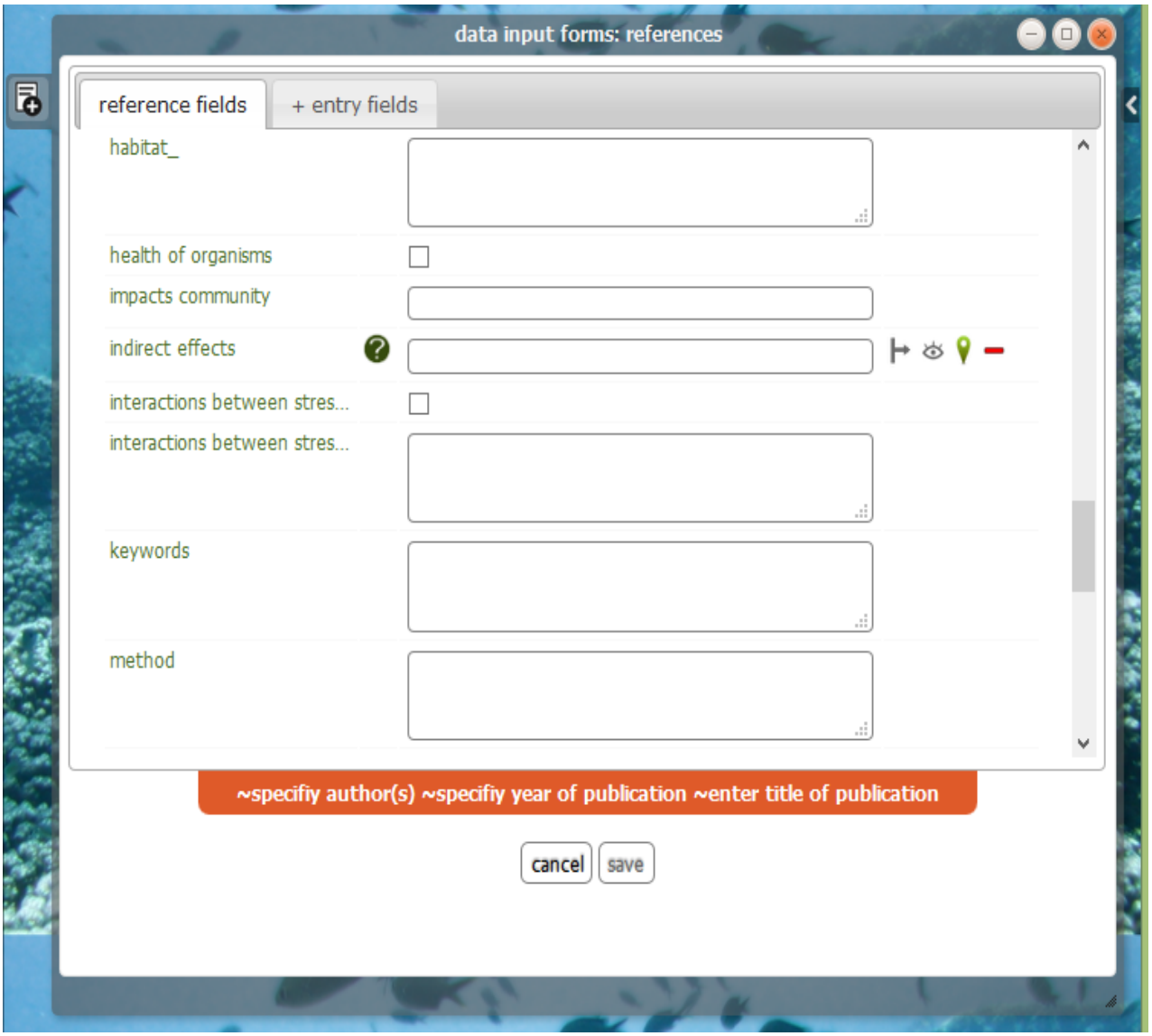

Figure 16: Data input form – entering optional data

When you have entered all required data, click on the *save* button. Inside the data entry window, a confirmation that the reference has been added to the database will be loaded. If the reference is already in the database, a notification message will appear. Each reference in the database has a unique identifier that is called *reference number*. The confirmation message includes the reference number of the last record added to the database. If you click on the reference number, an additional window opens with the *reference details* of the recently added record (Figure 17). Here, you can check if the data you've entered are correct. In case you want to change something, click on the red and yellow plus icon in the toolbar of the r*eference details* window (Figure 17, arrow 1).

For our scope, it is very important to attach the references you enter to the project. You can link a reference to a project either immediately after saving the reference (a list of projects is loaded under confirmation message immediately after saving the reference), or you can do this at any time inside the *reference details* window. Inside the *reference details* window, locate the row *reference in projects* and expand the list of projects (Figure 17, arrow 2). Mark one or more check boxes that correspond to projects to which you want to attach the reference (Figure 17, arrow 3).

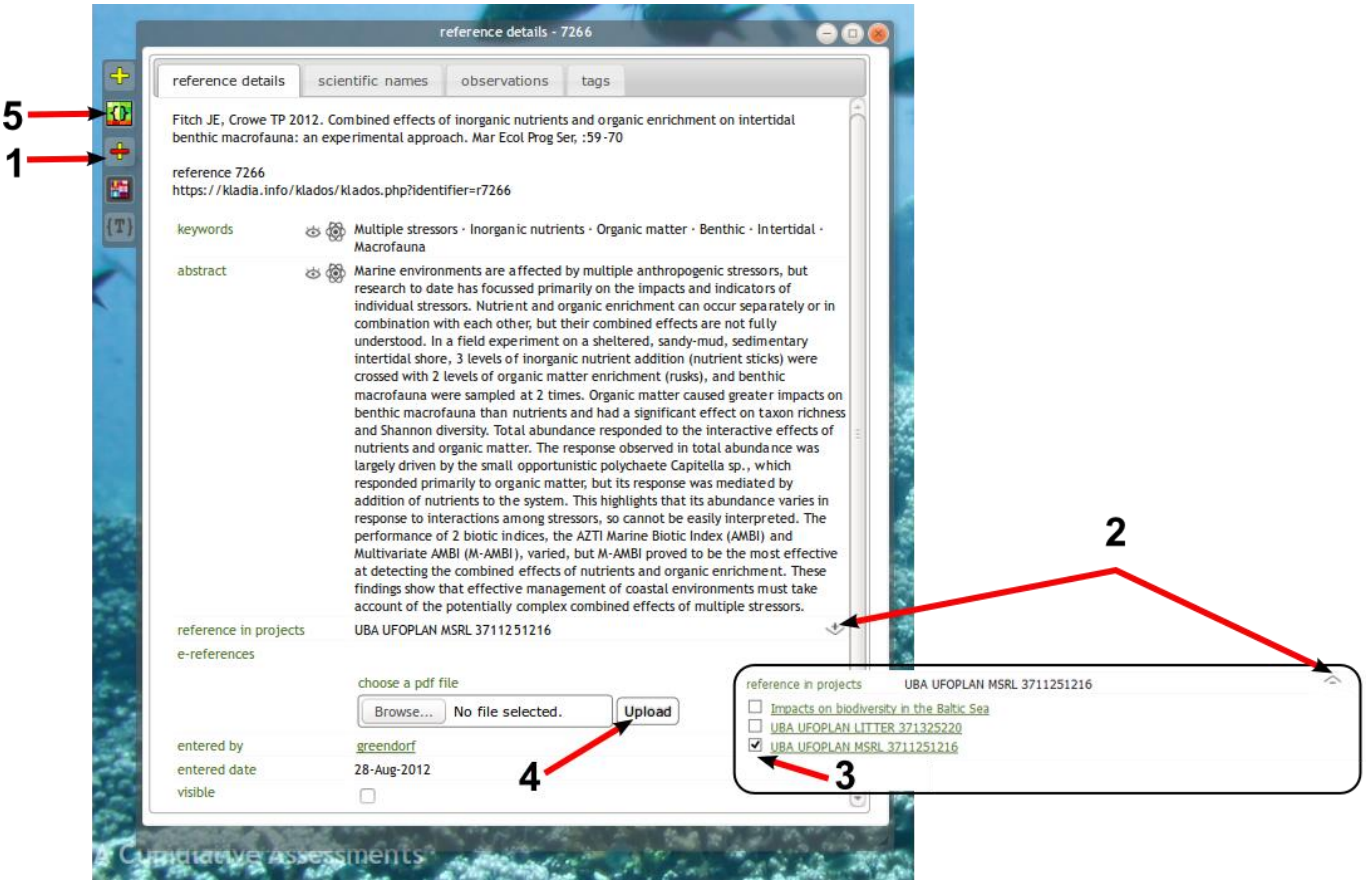

Figure 17: Reference details window

In case a reference is not added to a project, it will not appear in any other modules of the *referenceManager* or *Assessment Toolkit*. However, such not

assigned references can still be found via the general search for references and a click on the reference number visible to the left of the bibliographic information will lead you back to the reference details, where the reference still can be added to a project.

You can upload the actual paper as a PDF file (Figure 17, arrow 4). With respect to copyright issues, it is crucial to restrict public access to the paper in case it is not freely available online. This can be done by 'closing the eye' to the left of the web link to the paper with a single click (see arrow in Figure 18). Another click will turn the visibility on again.

Furthermore, you can add information on the species reported in the paper. In the *reference details window*, under the tab *scientific names*, you can inspect the scientific names mentioned in the respective publication. A link is provided to the data entry, so you may add scientific names mentioned in the publication. However, if you enter data about 'environ' relationships with the relationship editor, those species names will be added later on automatically here as well.

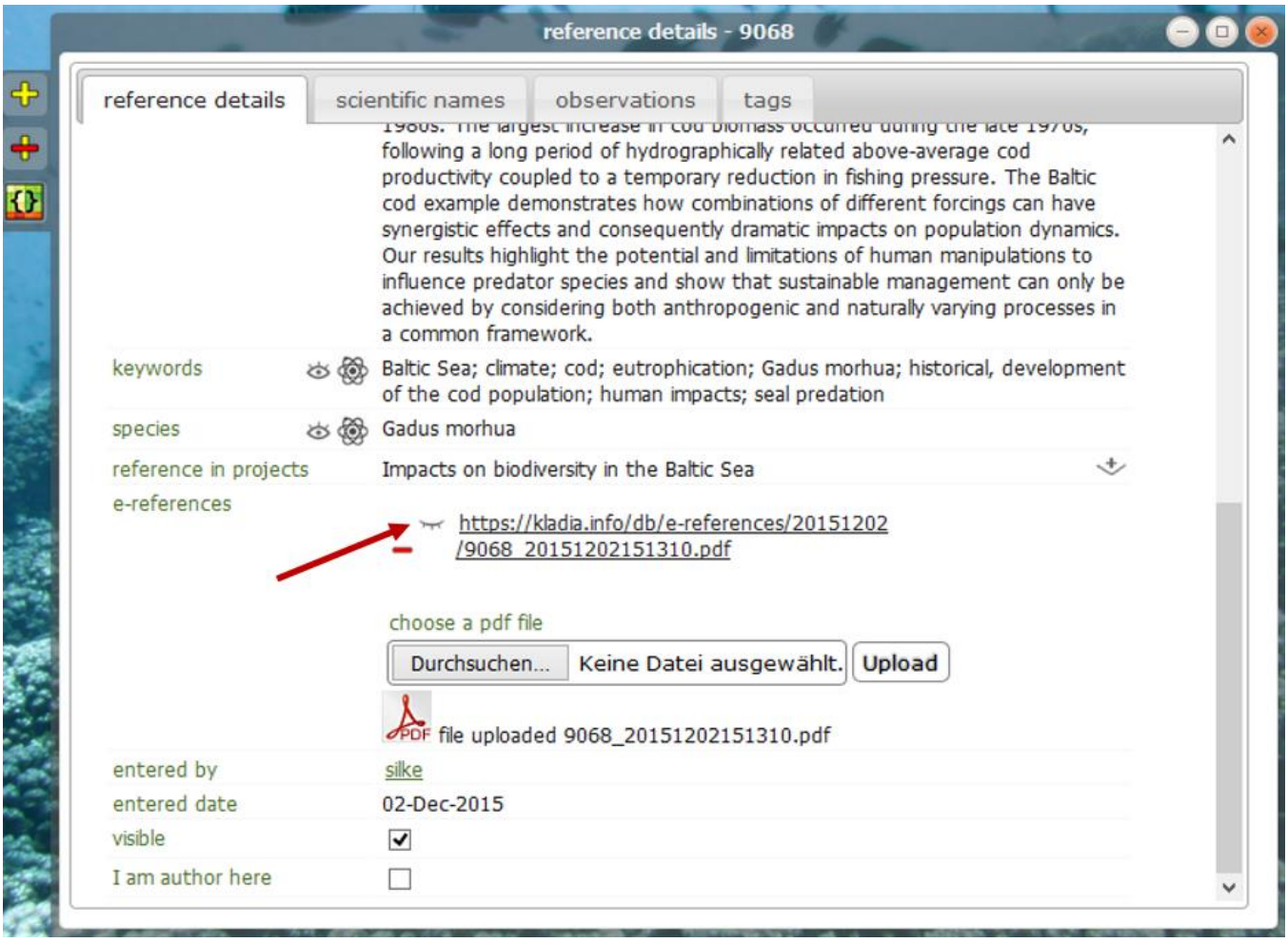

Figure 18: Visibility of publications and restrictions to access to the pdf file

Tagging references

For an efficient analysis of literature data, LiACAT offers several features to classify and filter the data records. This enables the user to create subsets of the entered references related to special topics. For that purpose, each reference can be tagged appropriately, using a set of standardized tags. This will be done in the *reference details* window by switching to the tab *tags*. In order to provide a standardized set of tags to be consistently used by all members of a project within mybiOSis environment, the tags may be organized in the form of a classification tree.

If a tag classification tree has already been built for a project of which you are a member, you can use the given structure for tagging (Figure 19). The checked tags in the classification tree appear also in a list above the classified tags. Untagging can be achieved either by unchecking a check box in the tag classification tree or by clicking on the minus sign right next to a tag.

If there is no predefined tag classification and you have administrator status for the project, you can build your own tag classification structure. As first step, you will have to decide on a set of tags and add them to a reference using the input field near the *add tag* label (Figure 19). After adding the tags, select your project from the project list and click on the button right next to it to open the reference tag manager (indicated by the red arrow in Figure 19; the tooltip is *reference tag management*).

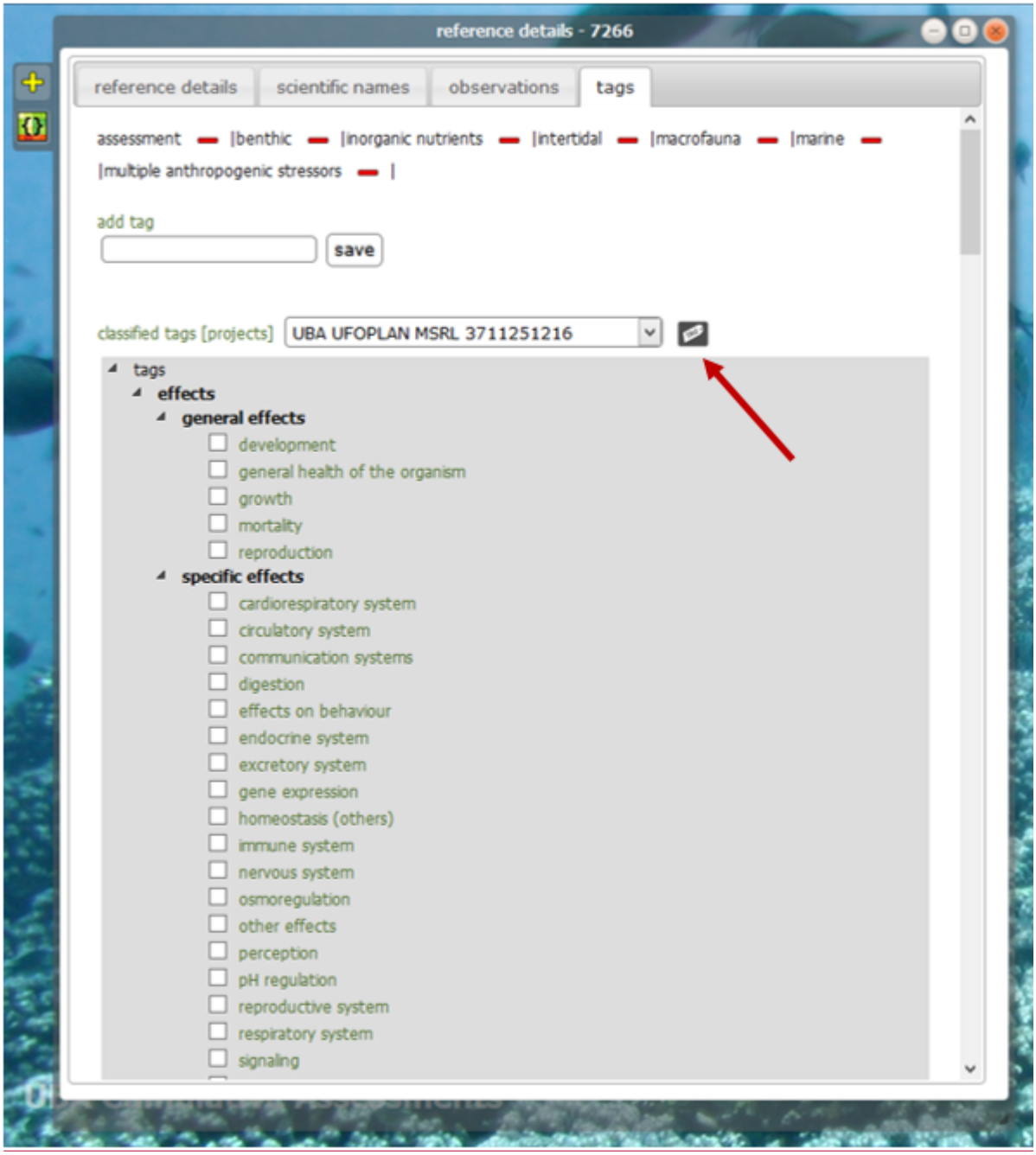

Figure 19: Selecting and adding tags for the filter

In the left panel of the tag classification manager, you will see the recently added tags (as unclassified tags). These can be added to branches in the classification tree via drag & drop operations (Figure 20). It is also possible to add new branches to the classification tree, to delete the branches, or to edit them by opening a contextual menu with a right-click of the mouse positioned on the respective branch in the right panel (Figure 20). Tags can also be removed from the tree by choosing the appropriate function from the contextual menu: place the mouse on top of the tag you want to remove, do a right-click and again click on the menu item *remove tag*. The respective tag will move back among the unclassified tags within the left panel. It is also possible to move entire branches inside the classification tree by drag & drop operations.

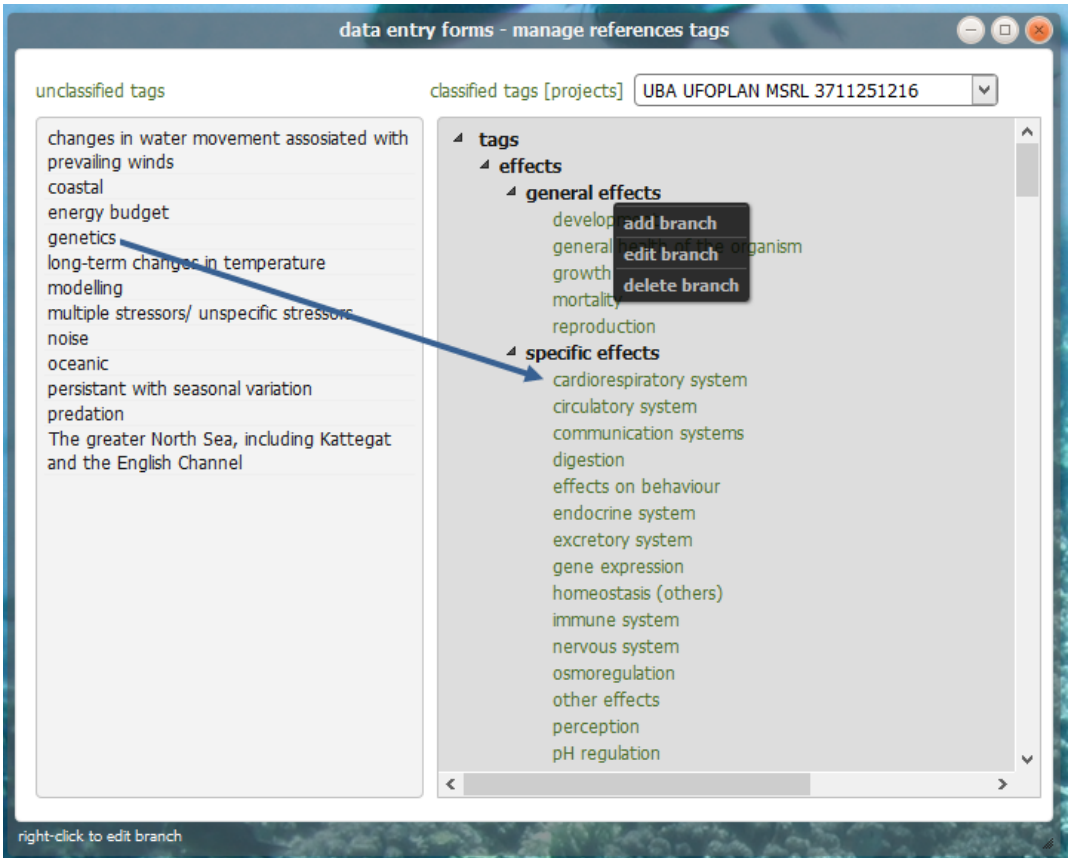

Figure 20: Managing reference tags

Relationships editor

For adding data for the references, open a reference in the *reference details* window. This can be done from anywhere in the system where you see a link with a reference number (in the *reference Manager* spreadsheet-like table, in the *References* search results, throughout the *Assessment toolkit* modules, in the organism observation details windows for observations that come from digitized literature etc.), or by searching the reference using its identifier in the general search box (for references identifiers place the letter *r* in front of reference number). In the reference details toolbar (upper left corner of this window), you will find an icon-button (coloured background with two curly brackets, Figure 21, arrow 5) with the tooltip *assessment causal relationships editor;* this toolbar button will lead you to the relationships editor (Figure 21 and Figure 22).

New relationship groups can be added after clicking on the yellow plus sign icon-button in the toolbar of the relationship editor (Figure 21 and Figure 22).

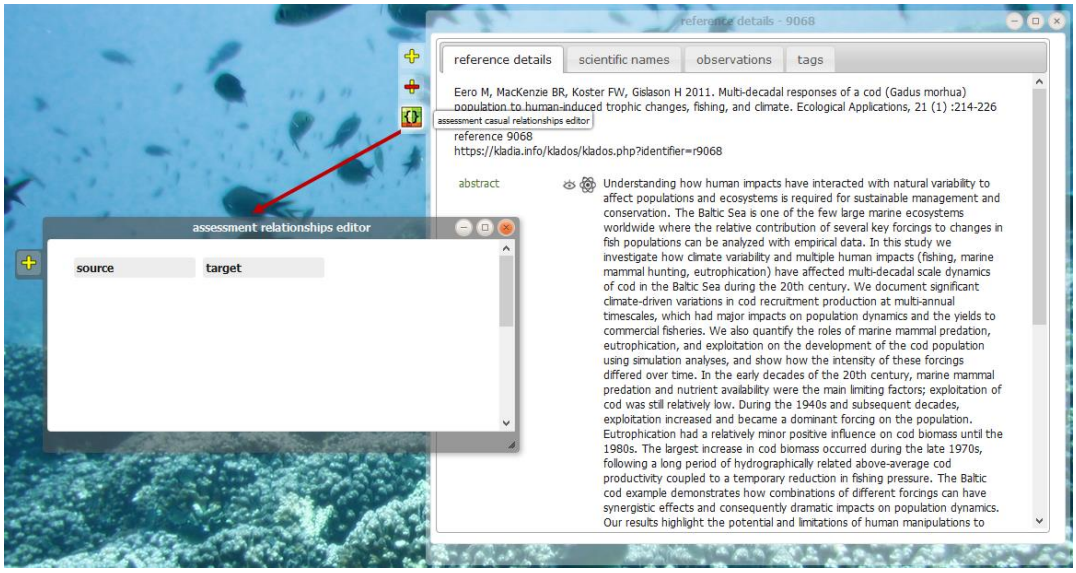

Figure 21: The assessment relationships editor

The terms 'source' and 'target' have only been chosen to indicate the direction of the relationship and do not refer to common definitions. Sources are usually different kinds of anthropogenic pressures or environmental stressors, which affect different targets of the organism such as the reproductive capacity, but they can also be observations: for example, a reduced overall health (indicated by the condition index) can lead to an increased probability of death. In that case, the source will be the 'condition index' and the target will be 'mortality'. Targets typically refer to effects caused by anthropogenic pressures, such as (increased) mortality. However, here it is also possible to change the perspective. For example, for describing the effect of shipping in several steps the relationships can be added in the following way: first relationship group: source: shipping – target: noise; second relationship group: source: noise – target: hearing capacity, third relationship group: source: hearing capacity – target: mortality. This will reflect the fact that shipping increases the noise level in the marine habitat damaging the hearing capacity of whales or other sensitive organisms. The reduced ability to hear due to a damage will in turn increase the probability to die, caused by a reduced orientation and an enhanced stranding risk. Both, sources and targets, are called environs, which are elements forming a network of relationships.

If more than one source leads to one target, an additional relationship can be added to a relationship group via a right-click on the respective relationship group (Figure 22). The target should in this case have the same name as for the first relationship of this group as shown for the combined effect of salinity and temperature on growth of blue mussels (Figure 22).

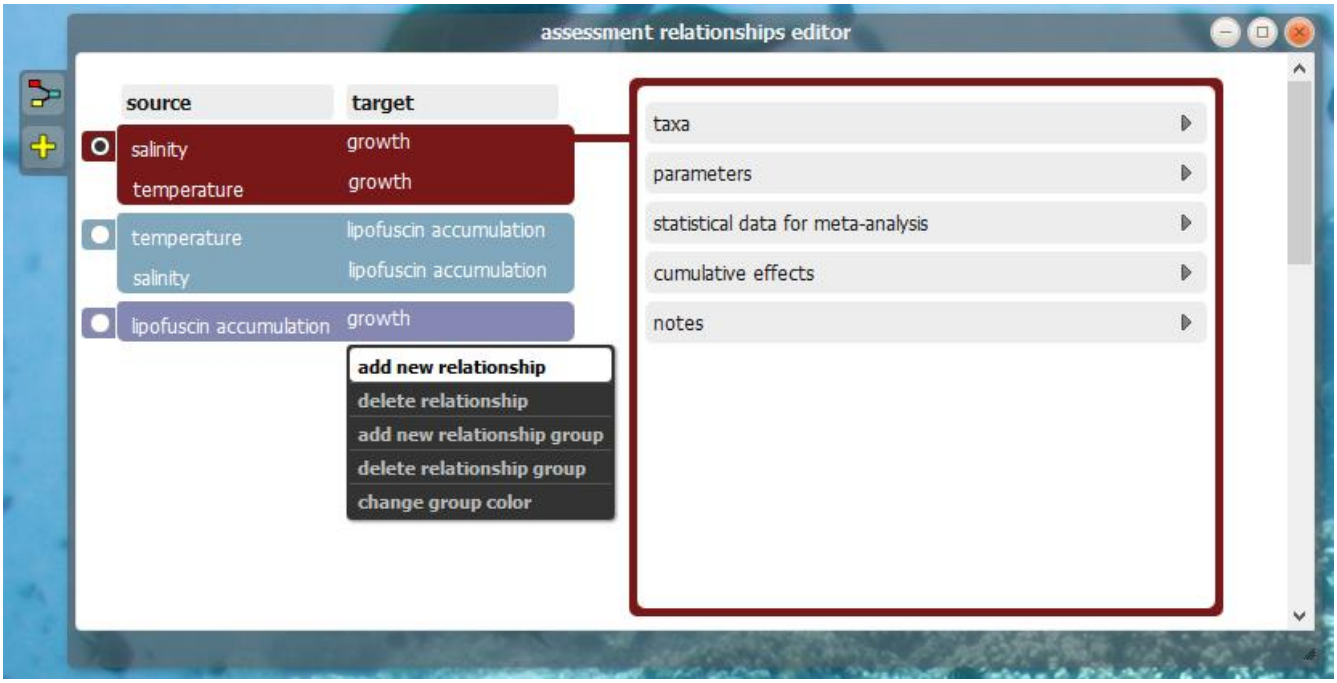

Figure 22: Adding relationships to relationship groups

In case, it will not be clear, which environ will reflect the source and which one the target (for example, this is often the case for different chemicals), e.g. the two chemicals interacting should both be treated as sources and the target be named 'chemical A chemical B interact', in order to indicate the interaction between the chemicals. Often, such relationships are observed with regard to a biological relevant effect. In that case, 'chemical A chemical B interact' should be entered as a source and e.g. 'growth' as a target.

Once a new relationship group is entered into the system, more detailed information can be added: after selecting the relation group of interest by marking it at the dot to the right (radio button), you can switch to the graph editor by clicking on the icon symbolizing a relationship group in the toolbar of *relationships editor* (located above the yellow plus sign in Figure 22). The relationships editor will switch to a graph editor view and you can specify the nature of the relationship: in the graph editor, the environs appear as boxes with plus and minus signs indicating respective possible increases/ reinforcements and decreases/ reductions. You can move the boxes and arrange them in an appropriate way and draw a line with the mouse from one sign of a source to the sign of a target (Figure 23). At a later stage of the development, this detailed information will be used for a zoom-in function in a complex diagram that gives an overview over all the relationships involved in assessments ('Sankey' diagram). To switch back to the list view of the relationship editor, click on the toolbar icon-button labelled with the tooltip *relationship list editor* (Figure 23).

Graph editor

Relationships list editor

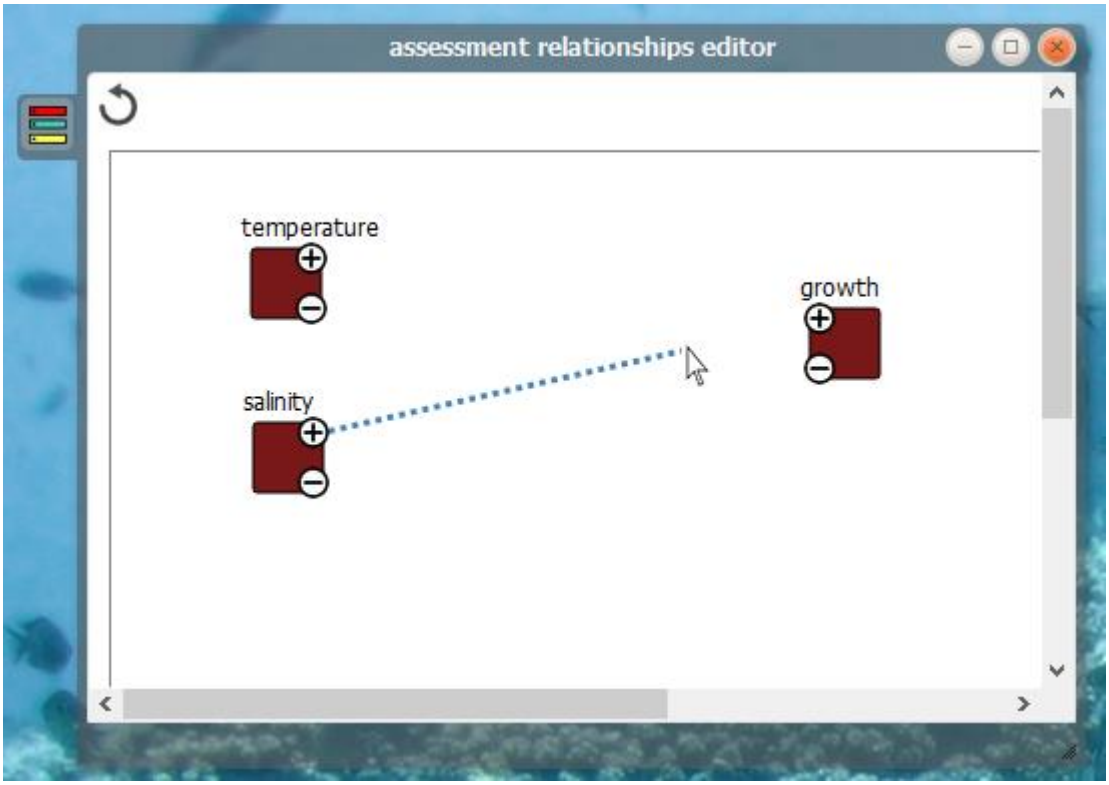

Figure 23: The graph editor

Here, in the *relationships editor*, you can specify to which taxa the relationship mentioned in the publication refers. This will be done by a right-click on the panel labelled taxa (Figure 24). Once a taxon is added, it will also be possible to get more information about the species such as the possible special status as well as its classification or the respective common names in different languages. If this information is not already available on the mybiOSis online platform and displayed by clicking on the corresponding link, you can add the information here.

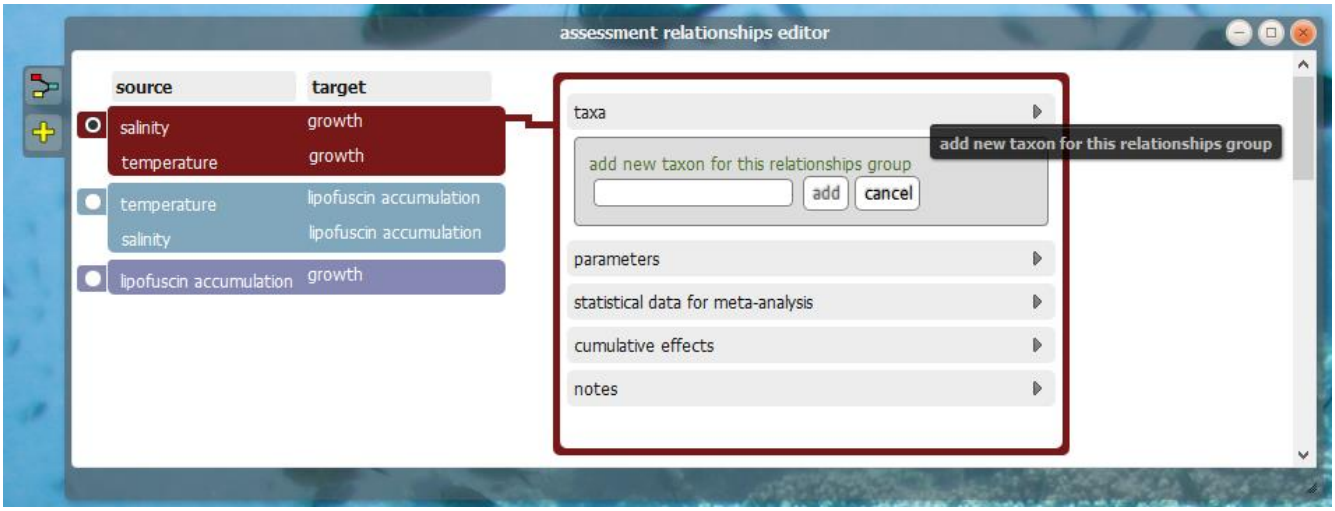

Figure 24: Adding taxa to a relationship group

Furthermore, it is possible to add information about the experimental or environmental conditions with regard to the relationship. This again is done by a right-click on parameter panel as shown in Figure 25. The entered information is relevant for a later interpretation of various relationships and for an improved understanding of the differences between publications and experiments, as the nature of a relationship may change dependent on these conditions. With a right-click on the word *parameter*, a black box will appear leading you with a left-click to the entry form. If a parameter name is entered, a unit will automatically be proposed, which is based on former parameter entries. This feature facilitates a consistent use of units. Furthermore, the data entry format of the new parameter has to be defined (for example, a range of data or a fixed value). Additionally, statistical values such as standard errors for the parameter mean values can be added here (Figure 25).

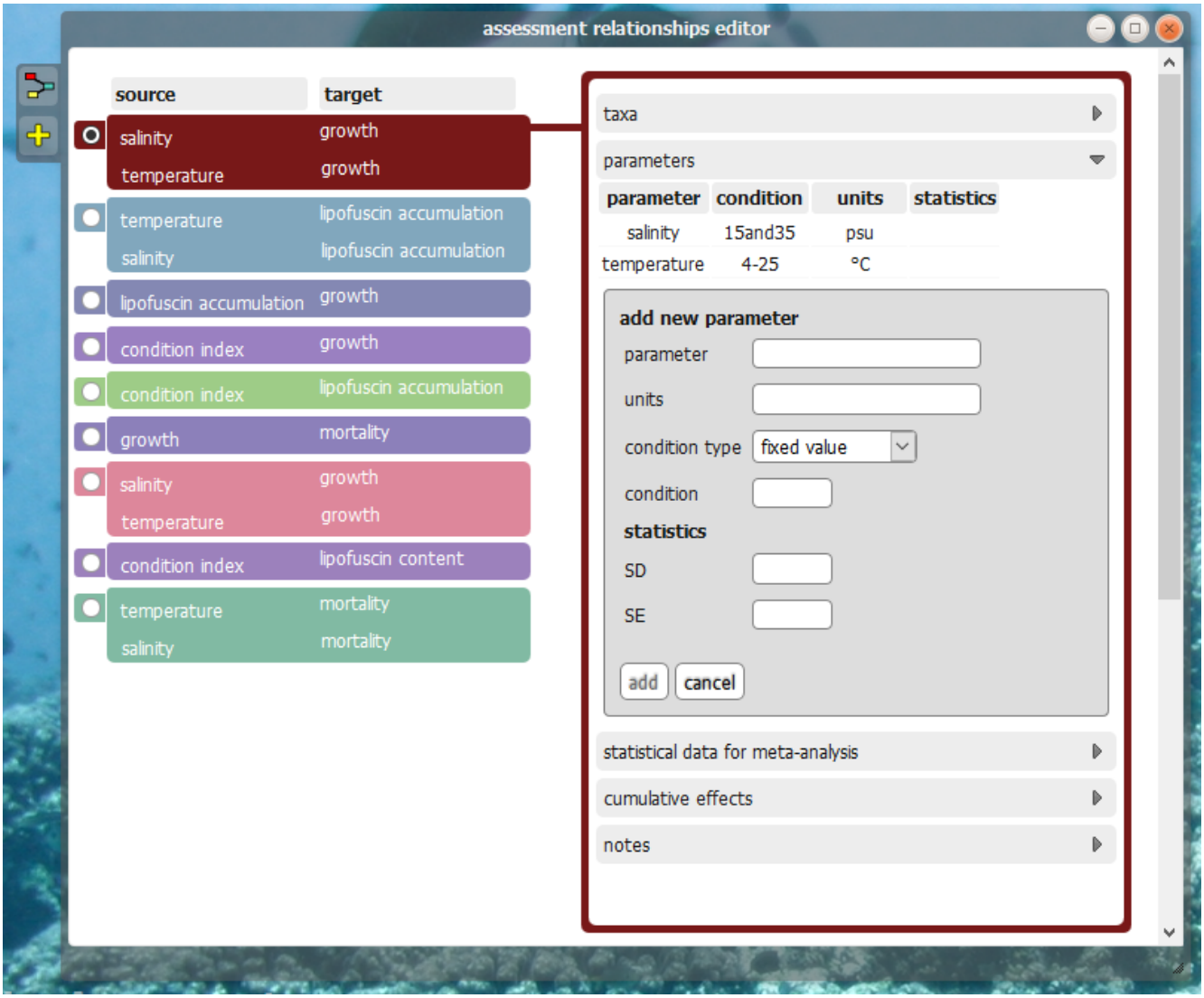

Figure 25: Specification of the conditions and corresponding parameter values with regard to the relationship

In the same window, you can enter statistical data and data needed for meta-analyses for each relationship (Figure 26). Depending on the type of data available in the publication, data can be entered for treatment comparisons, regression based data, and for net per capita growth rates.

After putting in the data, click the button *save*. It will always be possible to remove and edit an entry in these forms with a right-click on the grey area opening a corresponding menu.

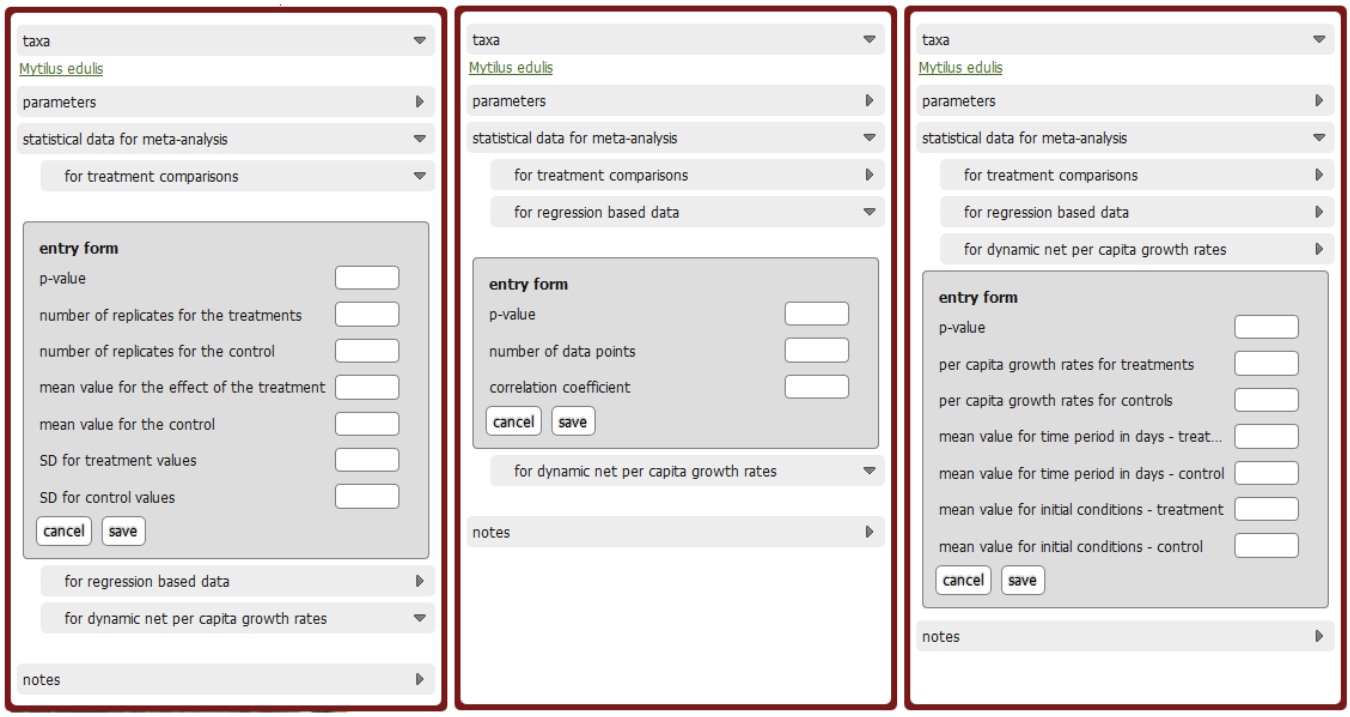

Figure 26: Data entry for meta-analyses

Under the entry *cumulative effects* in the relationship editor information about cumulative effects can be added (Figure 27). Within the publications, the term 'cumulative' is used in various ways. For that reason, we distinguish between three different models, which Folt et al. (1999) have described. Depending on the model, the corresponding terms synergistic and antagonistic describe different kinds of interactions. Folt et al. (1999) gave the following brief definitions:

In the ***multiplicative model***, the term 'synergism' means that the overall effect of two or more impacts is greater than the product of the two or more single effects. By contrast, the term 'antagonism' describes an overall effect that is smaller than the product.

In the ***additive model***, the term 'synergism' means that the overall effect of two or more impacts is greater than the sum of the two or more single effects; the term 'antagonism' describes an overall effect that is smaller than the sum of all effects; an 'additive' effect is the sum of all effects.

In the ***simple comparative model***, the term 'synergism' means that the overall effect of two or more impacts is greater than the effect of a single worst or dominant stressor alone; the term 'antagonism' describes a combined effect that is less than the effect of the single worst stressor.

In general, cumulative effects only refer to a relationship group consisting of different sources influencing one target. For that purpose, several relationships have to be added to one relationship group, which have the same name for the target. Preferably, the additive model should be used for the cumulative effect

analysis, because the null hypotheses of this model is a basic assumption of many assessment concepts.

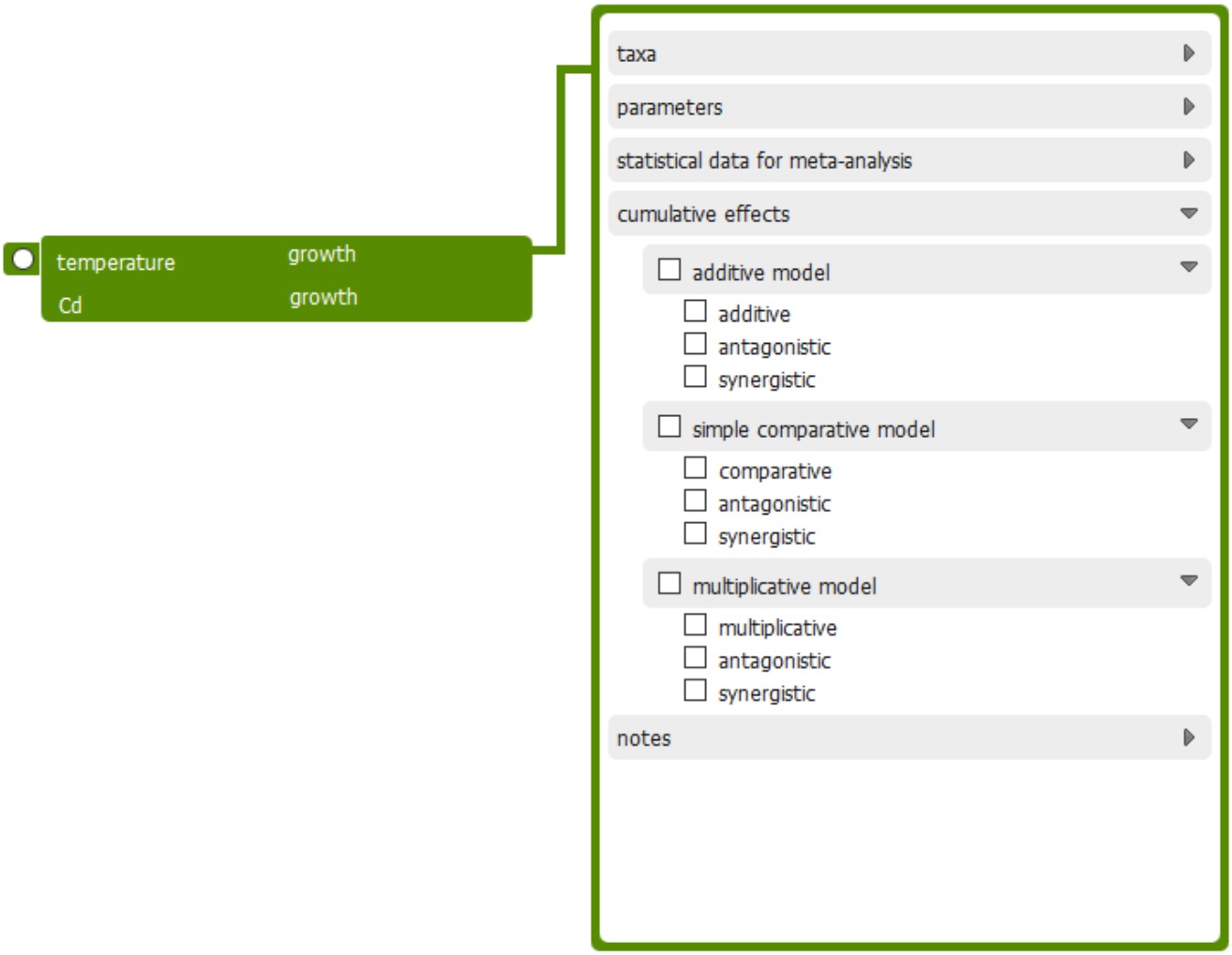

Figure 27: Adding information about cumulative effects with regard to a relationship group

For each relationship group, a further field is reserved for notes, where any kind of additional useful information can be added (Figure 27).

References Manager

To open the *referencesManager*, go to the main view of the *Water Quality Assessment Toolkit* (Figure 14) and then click on the icon '*Manager: References*' in the menu to the left. The *referencesManager* (Figure 28) has a tab structure with two sets of nested tabs. The outer set of tabs includes the tab *query* that is used to define criteria for database requests, and the tab *sheet* displaying the data based on the criteria defined in the query. Please, note that in the outer set the tab called *sheet* is inactive by default. This tab will be enabled only when one or more projects are checked in the *projects* query subtab (Figure 28).

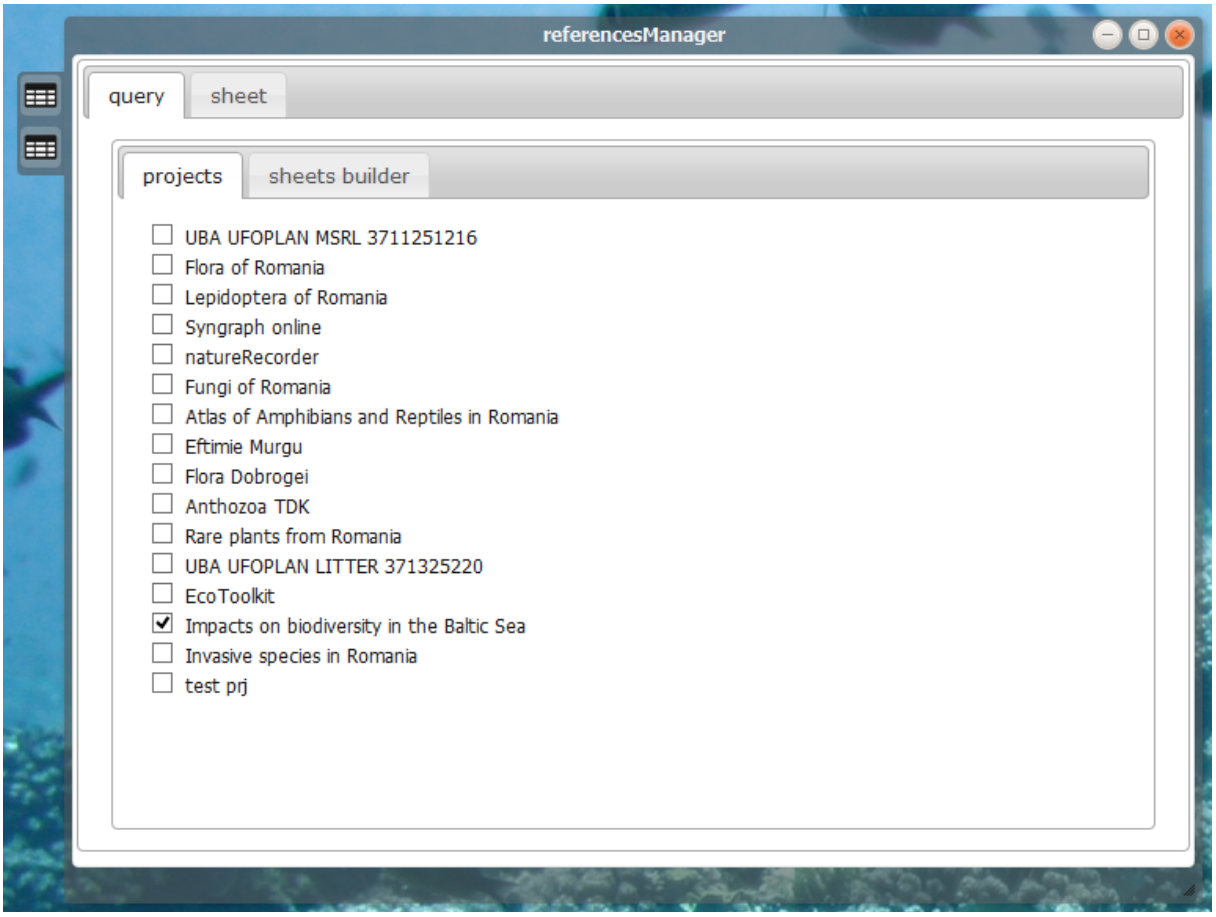

Figure 28: Reference manager - general structure

If one or more projects are checked, then the sheet tab will become active. However, at this stage the sheet tab would only load a table with basic bibliographic information (authorship, year of publication, title, type of reference, links to reference details). To add more fields, click on the sheets builder tab and check the optional fields of interest, which should be included in the table at the left side of the panel (Figure 29). The order of fields in the list to the left can be changed very easily by dragging a field to the desired position. The setting will be saved automatically. Choose an appropriate sheet name and save your customized sheet structure to add it to the database and make it available immediately when you open the *referenceManager* the next time. If you click on the save button to the right of the sheet name without having changed the name of the list, the current list will be overwritten.

Once a table has been defined in the sheets builder, click on the sheet tab from the outer set of tabs. A table containing all references associated with the selected project and the selected optional fields will appear (Figure 30). Here you can enter search terms under the header position of the table for each topic. To reset the search value, click on the cross sign to the right of the search field. For editing the table, click on one row to highlight it. At the bottom left corner of the table is a symbol of a pen. If you click on it, a new window will open to edit the data entries for the selected optional fields.

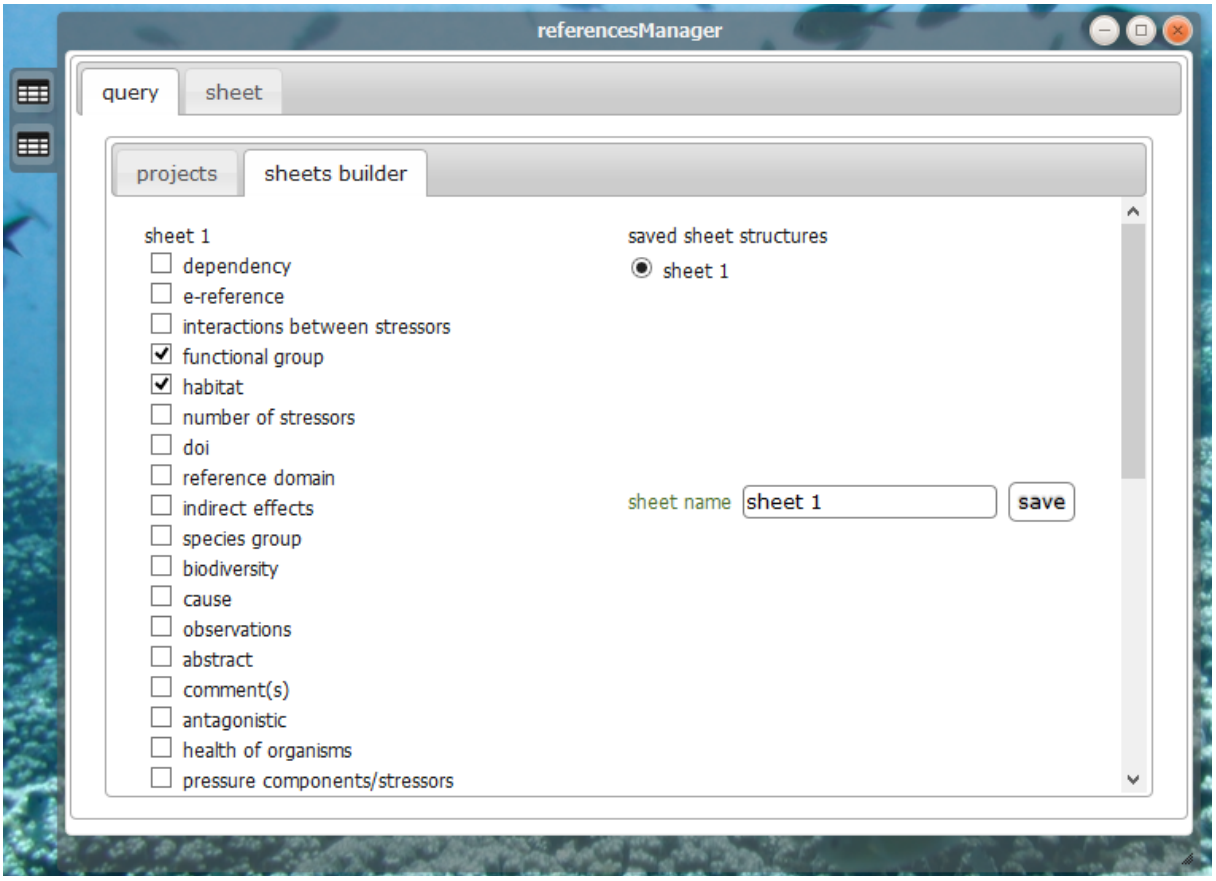

Figure 29: Sheet builder of the Reference Manager

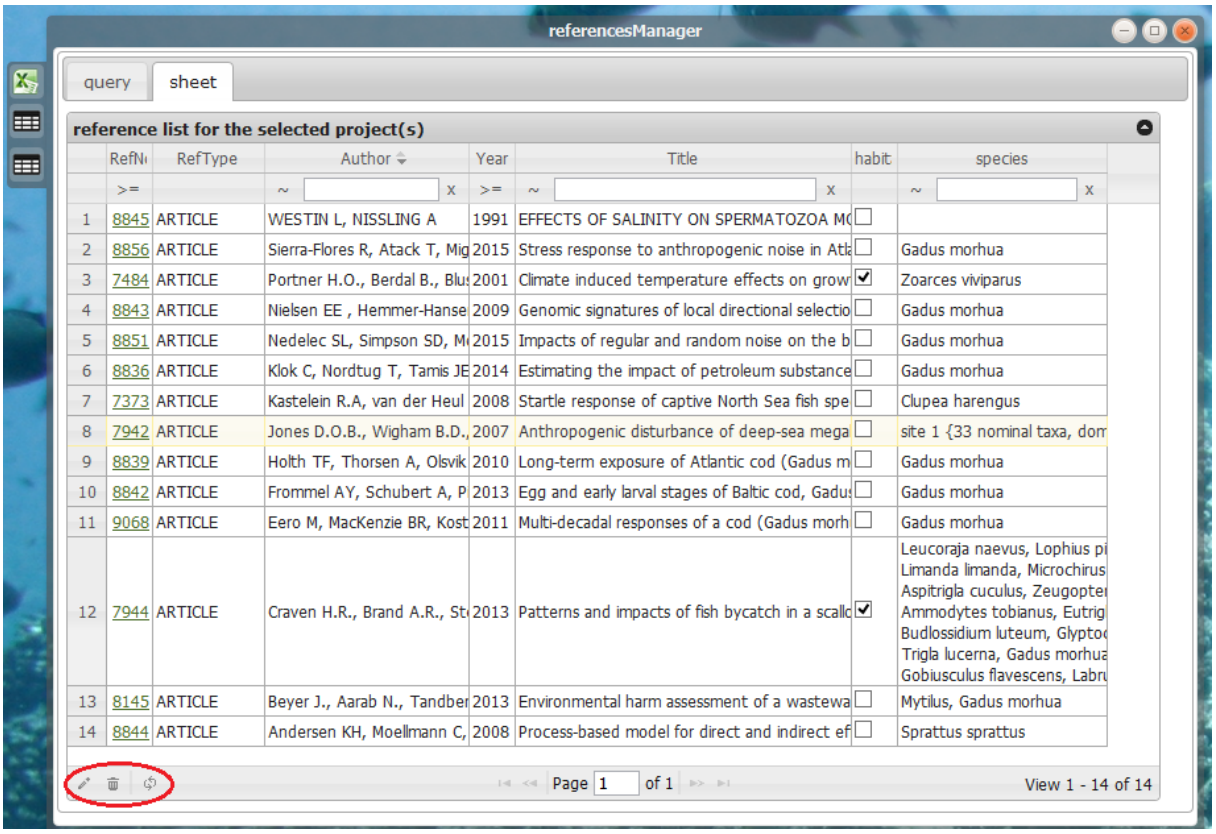

Figure 30: Reference Manager - Sheet

You can access the full details of a reference by clicking on the reference number link in the first column to the left. It is also possible to remove a complete row and thus a reference from a selected project by clicking on the bin sign at the button left of the table. However, this would not delete the reference from database: it will just delete the linkage to the selected project.

You might realize that there are already more functions and modules for analyses available. However, these are still under development. Therefore, this manual will be updated continuously.

If you have any questions, don't hesitate to contact us!

For questions regarding technical issues and the functionality of the system:

Dr. Adorian Ardelean: **aardelean@mybiosis.info**

For content related questions regarding the assessment concept, literature input, common understanding for literature interpretation with regard to the tool as well as for cumulative effects:

Silke Eilers: **eilers@aquaecology.de**