

# Image annotation with BIIGLE<sup>DIAS</sup>

DIAS is a web-based software for the manual annotation of benthic images. It is a successor of the software BIIGLE that is being used for the same purpose. Due to almost ten years of experience with the pros and cons of the BIIGLE design features, DIAS was developed to allow for a novel annotation strategy. Annotation thereby refers to marking pixels within images and not adding semantics to the images as a whole. DIAS is currently under heavy development and has to be seen as an alpha version that was adapted for the offshore operation on Sonne cruise SO241-1. DIAS is for image annotation only (no videos, frame grabs will work) and does not allow for live annotation (i.e. the annotation of live video feeds from the deep). The images have to be stored on the server for annotation.

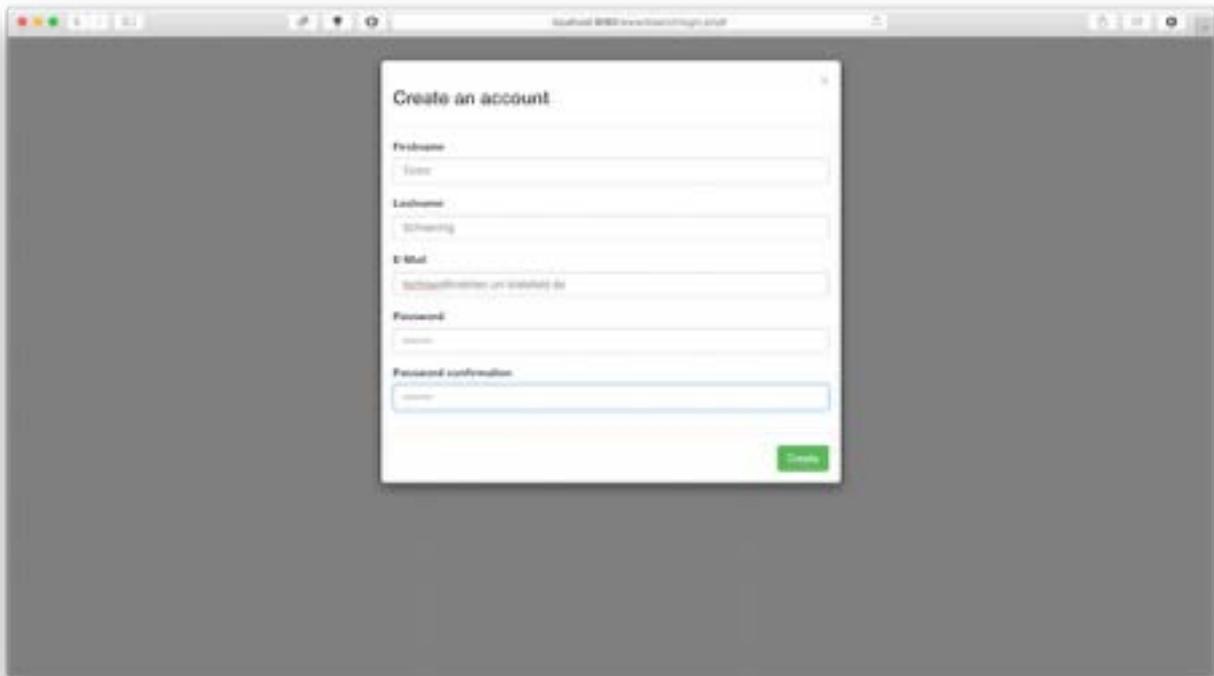
## Some keywords:

- **Annotation:** consists of a set of pixels (for positioning the annotation within an image) and a set of labels (for classifying what the pixels show). An annotation is always linked to the name of the expert who created it.
- **Detection:** The first step in creating an annotation where the set of pixels has to be defined that will later on be classified.
- **Classification:** The second step in creating an annotation where a given set of pixels is assigned with at least one class label. There are several synonyms for label of which “category” will also be used throughout DIAS.
- **Re-evaluation:** A central concept in DIAS where existing annotations are inspected by other experts do falsify or accept existing labels for an annotation.
- **Transect:** A grouping concept of images. BIIGLE was developed for the annotation of images acquired with towed gear. I different term is image set.
- **Project:** Transects can be grouped into projects. One transect can be part of multiple projects. User access to images is granted on a per-project base.

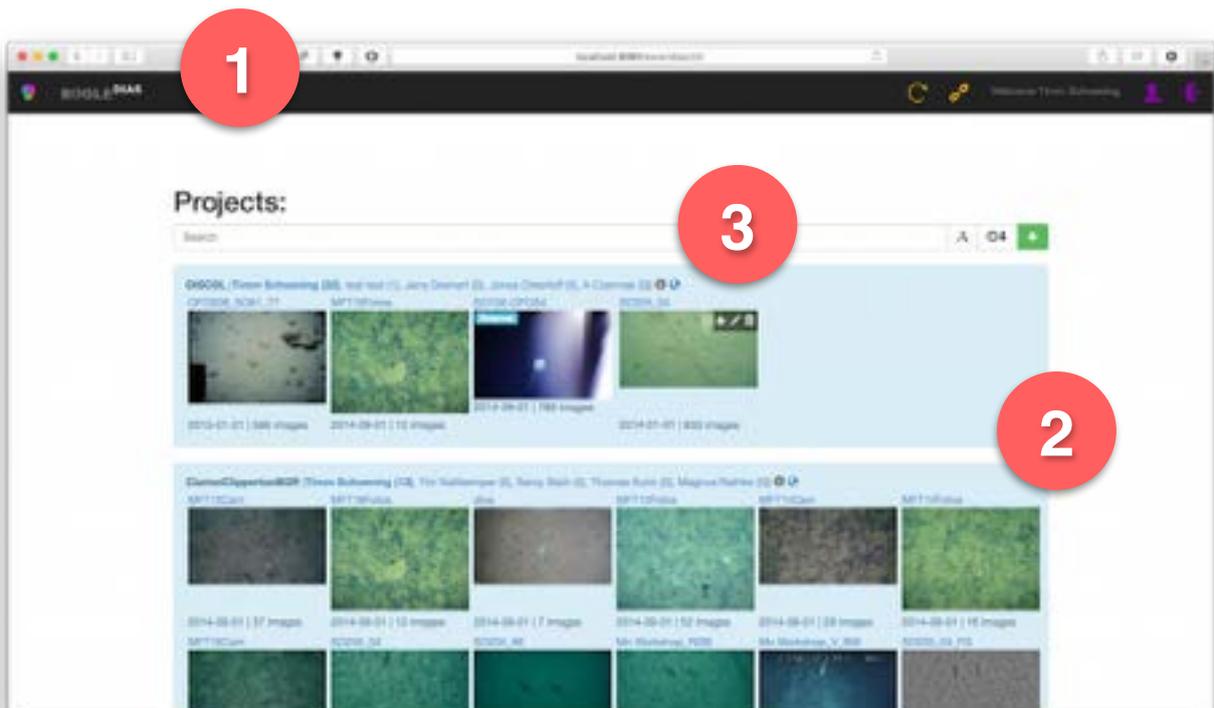
## Manual:



**Start page:** Before you can login, you have to create a user account

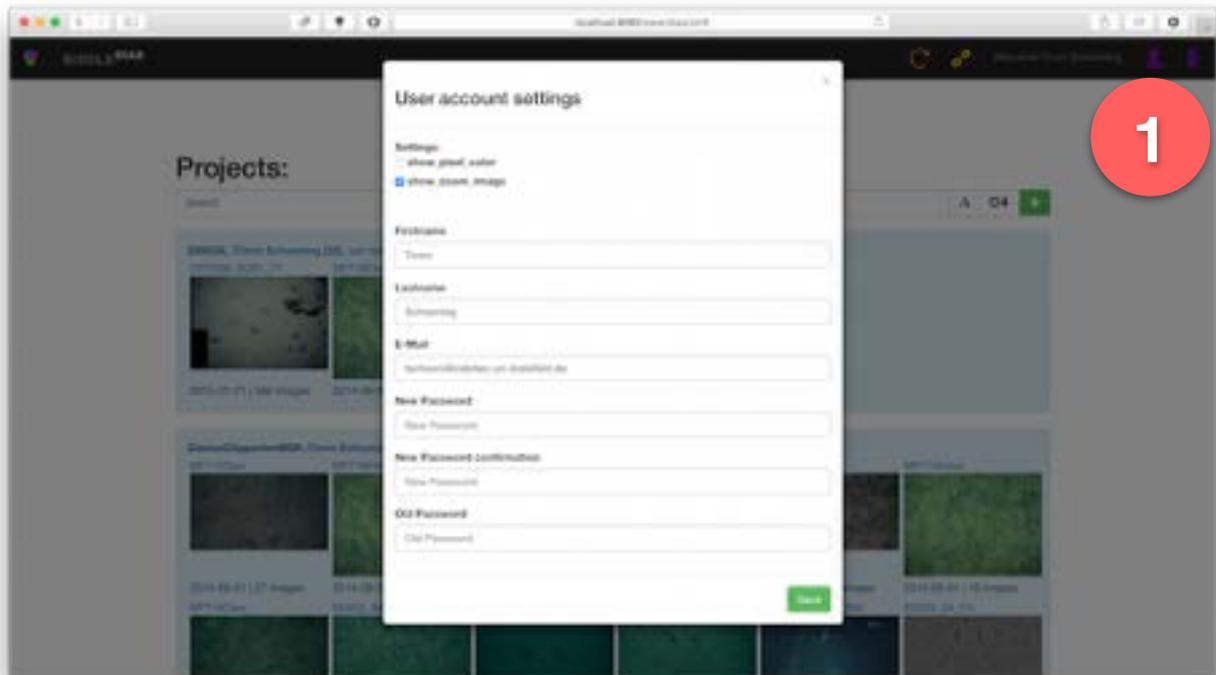


**Creating an account:** You have to specify your first and last name, email address and a password (that you have to repeat to prevent typos). The form says you will receive an email, which you don't in the offshore mode. You can simply login now.

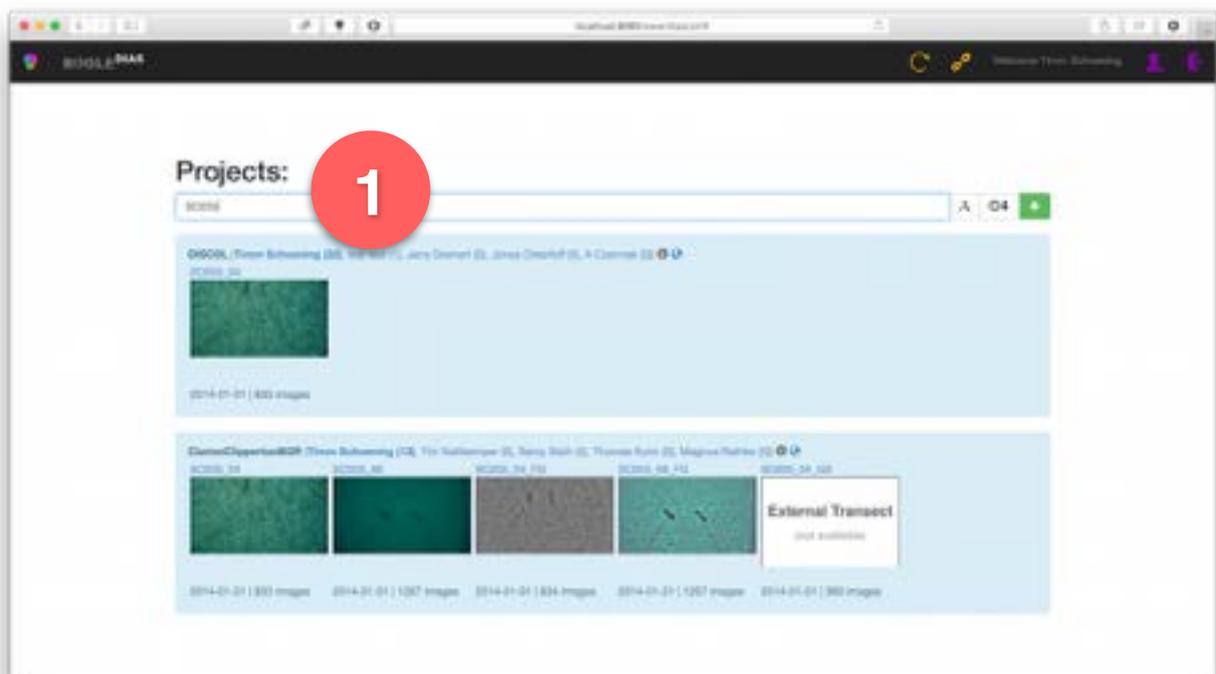


**Project overview:** This is the main page of DIAS from which you can access all your data. The dark top bar (1) is the main navigation where information is displayed (e.g. transect name, image name) as well as the buttons to access further functionality. A click on “BIIGLE<sup>DIAS</sup>” always brings you back to this project overview page. Each project is represented by one light blue box (2). Each thumbnail in that box represents one transect. At the top of each blue box, the project name is shown, together with a list of all members of this project. The number in brackets behind each annotator show the amount of annotations she / He has done in this project. Behind the names, the small globe icon leads to a map view of this project (3). Above each transect icon, the transect name is given and below it, the creation data and amount of images in this transect are shown. Moving the mouse cursor on top of a project eventually shows

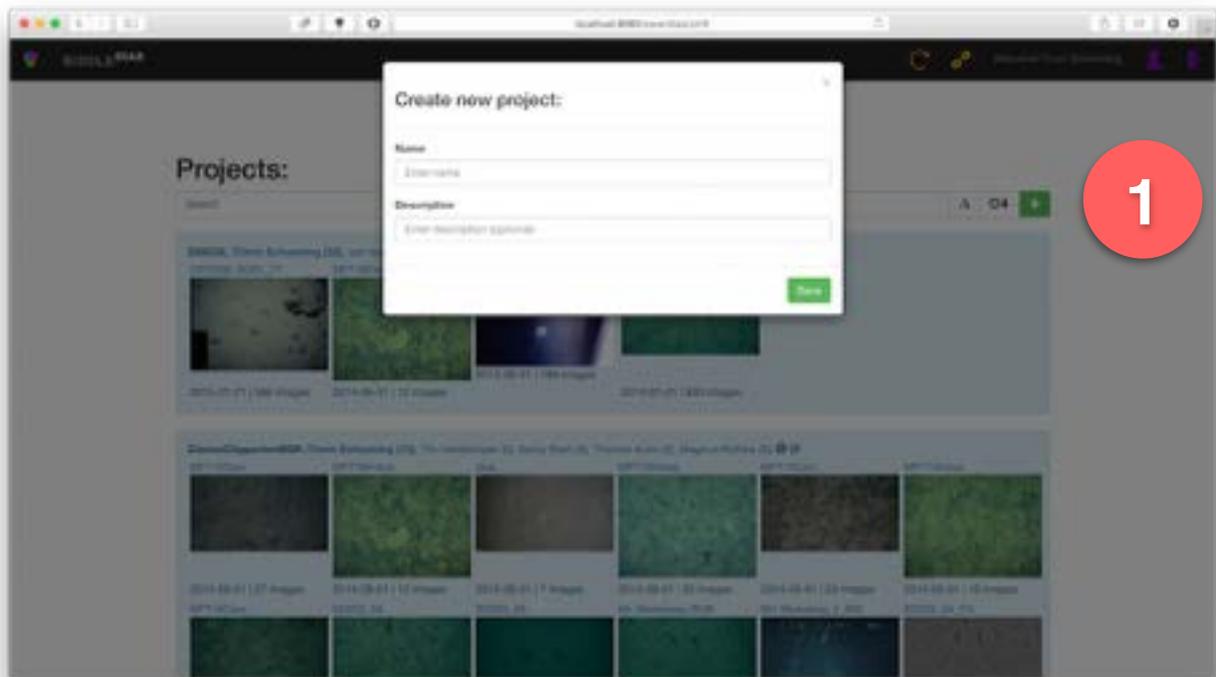
further functionality for the administrators of a project. Moving the mouse cursor on top of a transect thumbnail, provides, at least on some operating systems and browsers, a slideshow of the images in this transect for rapid assessment.



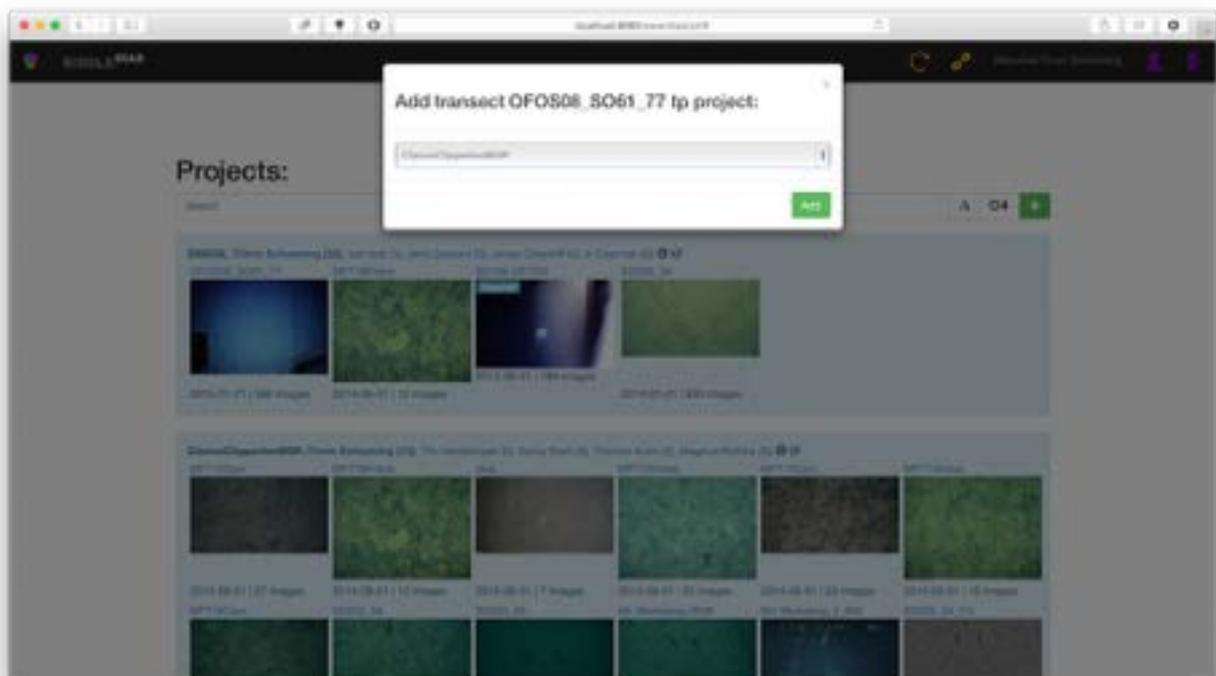
**User details:** You can change your account details as well as some tool options by clicking on the purple user icon to the right of the navigation bar.



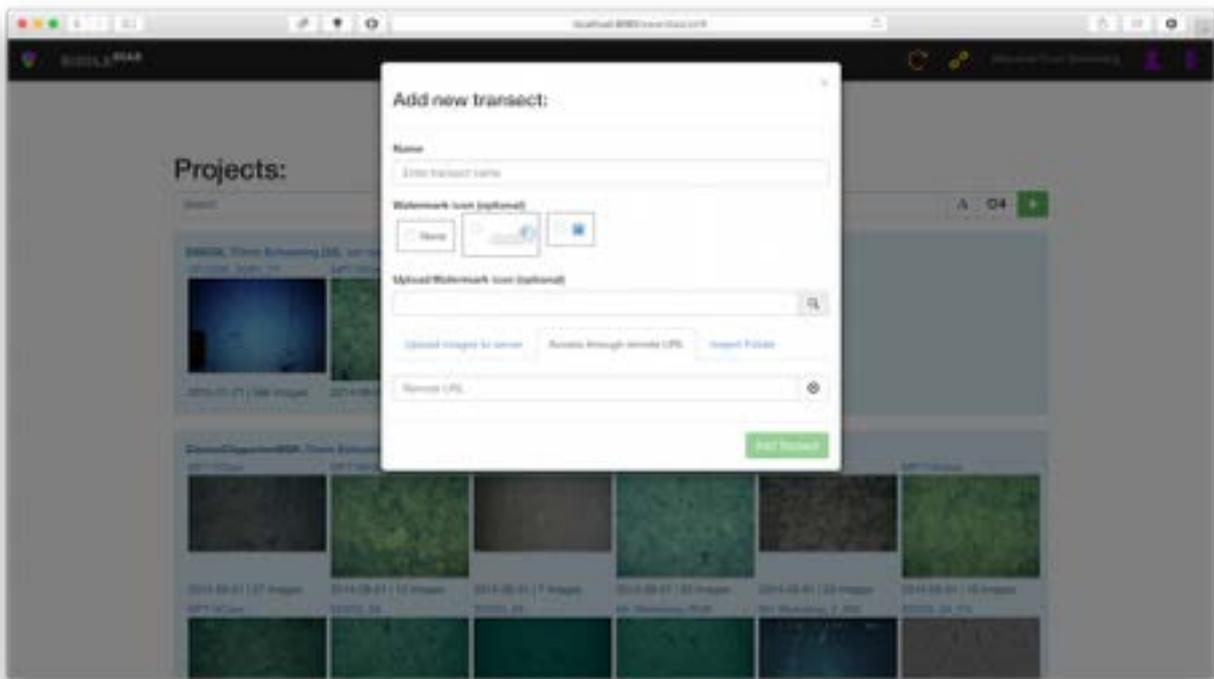
**Project search:** Between the dark navigation bar and the projects is a bar to search for transects and to order the transects by name or id. By typing in the search field (1), only the transects with a fitting name will be shown.



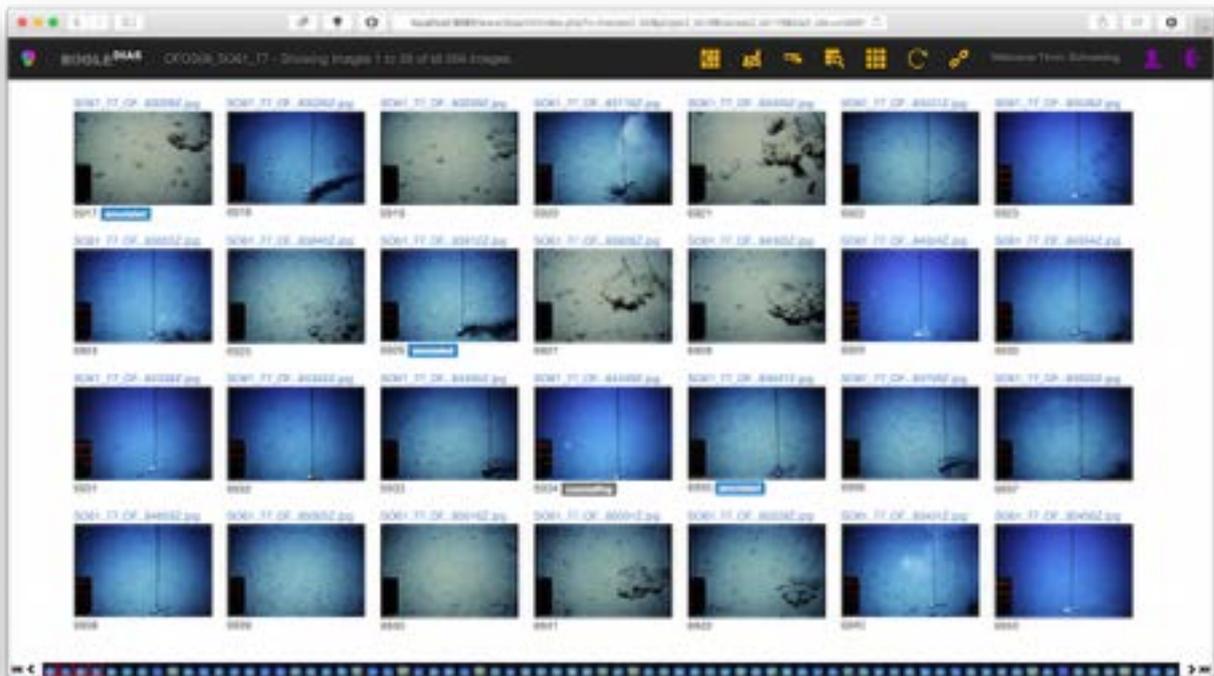
**New project:** You can create a new project by clicking on the green “+” button (1) in the search bar



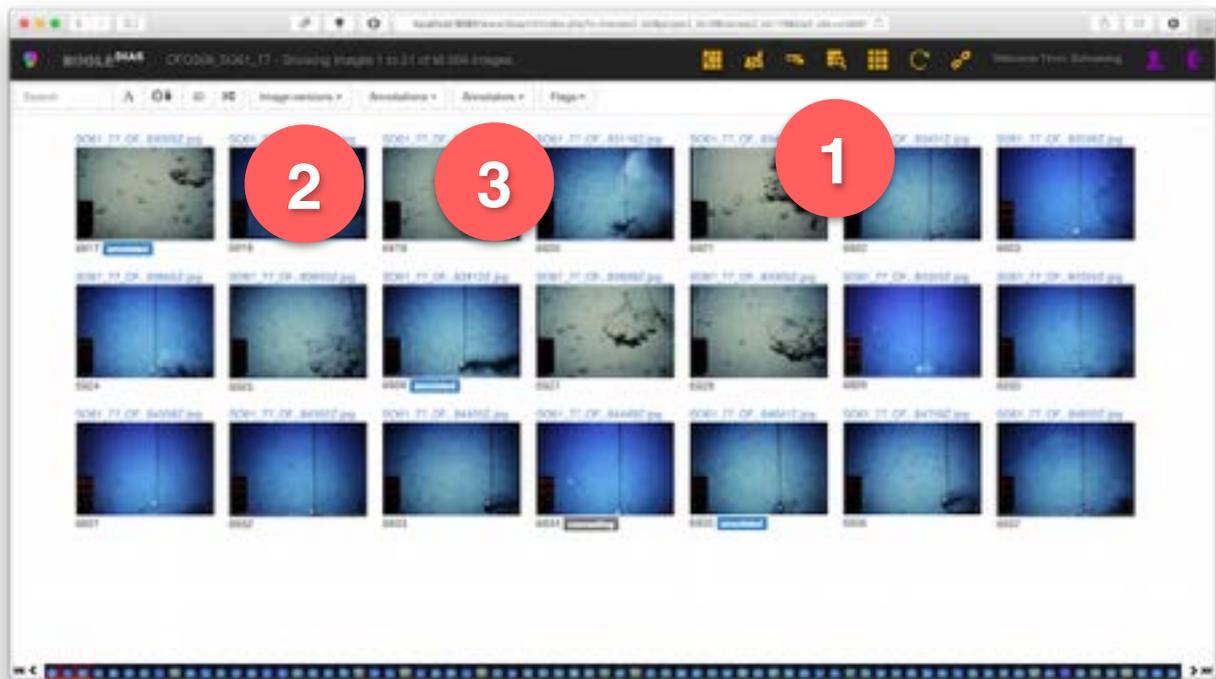
**Add transect to project:** Administrators of projects can copy a transect from one project to another by clicking on the plus button that appears for those users by moving the mouse cursor on top of a transect thumbnail.



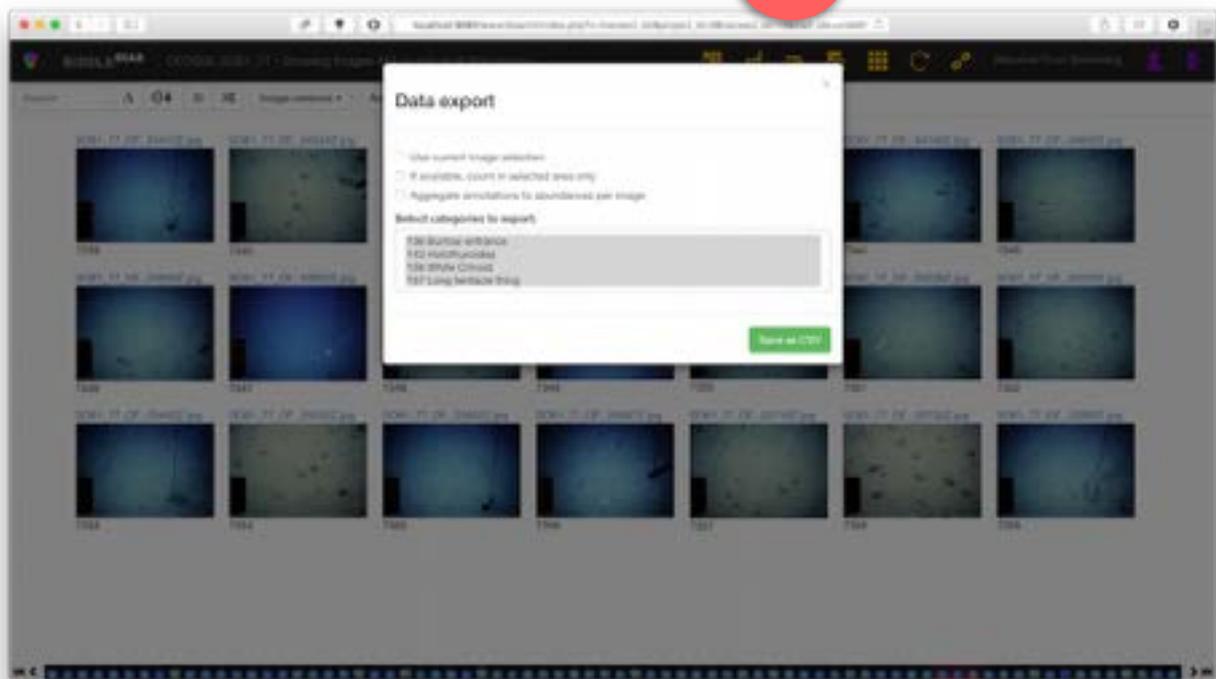
**Add new transect:** New data can be added to DIAS only by having access to the server, so talk to Timm Schoening if you want your images in there as well. Data upload is not yet implemented. If the images are on the server you can import them and also specify whether a watermark icon shall be shown on top of each image.



**Transect overview:** When you click on a thumbnail in the project overview, you are directed to the transect overview page. Here, each thumbnail represents an image of the transect. Above the thumbnail the name of the image is shown and below its ID in the database. Some badges may be visible that e.g. show which images have been annotated already. At the bottom of the page, is the navigation across the transect (1). Because only some thumbnails can be shown on the computer screen, a pagination is required. The buttons (“|<<”, “>>|”) on the corners move towards the beginning / end of the transect and the buttons next to them (“<”, “>”) move towards the previous / next page of thumbnails. Between the buttons, tiny samples from across the whole transect are shown. This is a subset of the whole transect but can show variations within the images along the complete transect. You can move the cursor on top of these tiny thumbnails to see a larger version and you can click on each of the tiny thumbnails to move the pagination to that part of the transect. The currently displayed thumbnails are highlighted in the tiny thumbnails list by red border

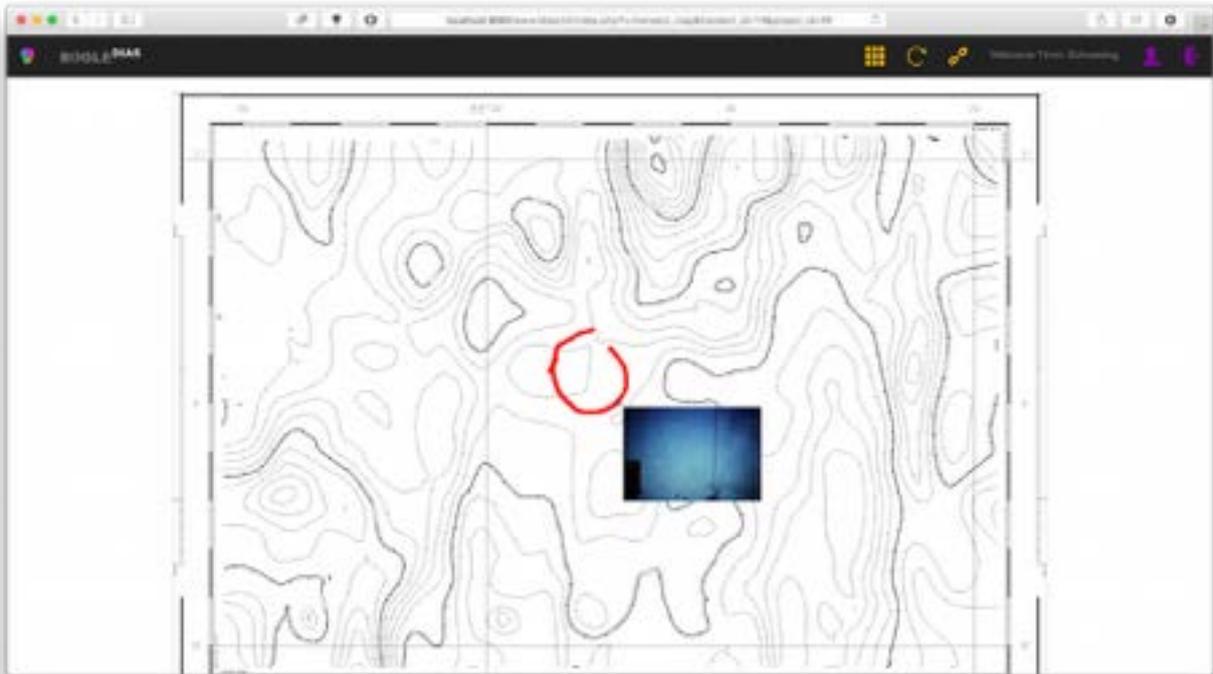


**Transect filtering:** A click on the transect filter icon (1) in the navigation bar displays a filter bar below the navigation bar. In there is a search field to find images by name, buttons to sort the images by name, date, ID and randomly. Random sorting can be helpful to randomise the annotation process for avoiding effects of fatigue. The following drop-down allows accessing processed versions of the images if available(2). The next three drop-downs contain information about who annotated with what labels which can also be used by clicking on the fields in the dropdown, to filter the images of the transect (3).

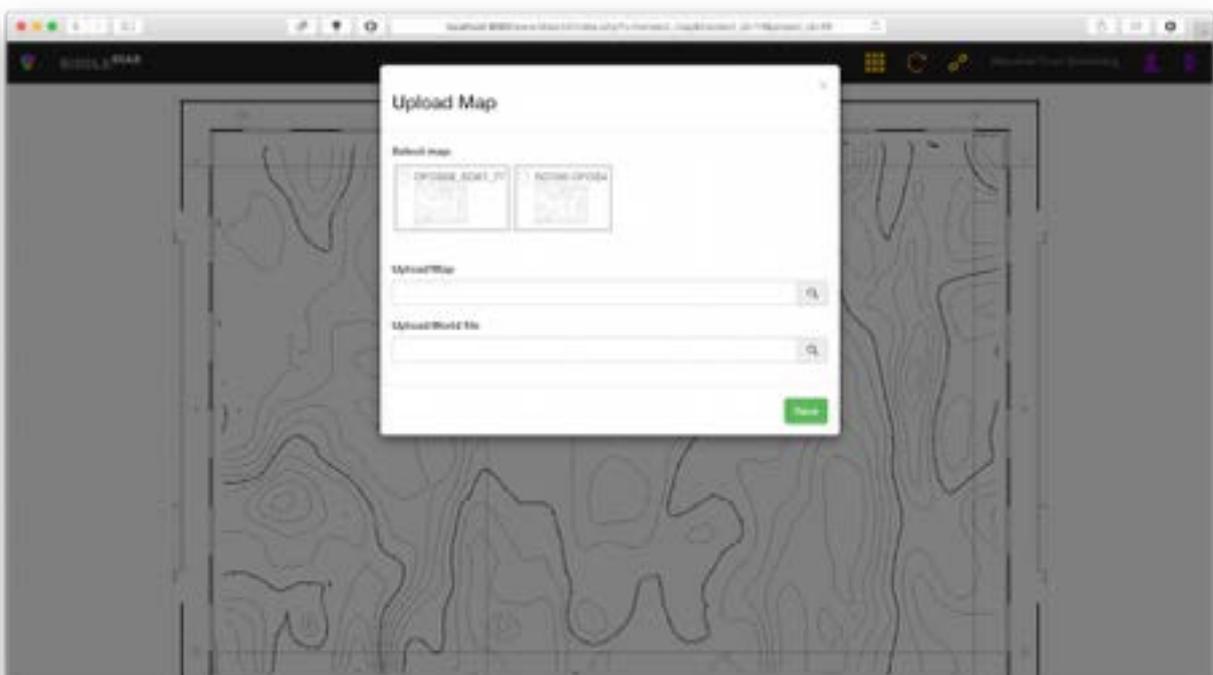


**Data export:** The annotations of a transect can be exported to a CSV file for following analysis. The export form is shown by clicking on the export button in the navigation bar (1). In the form you can select whether the export shall be done only for the selection of images you made by filtering

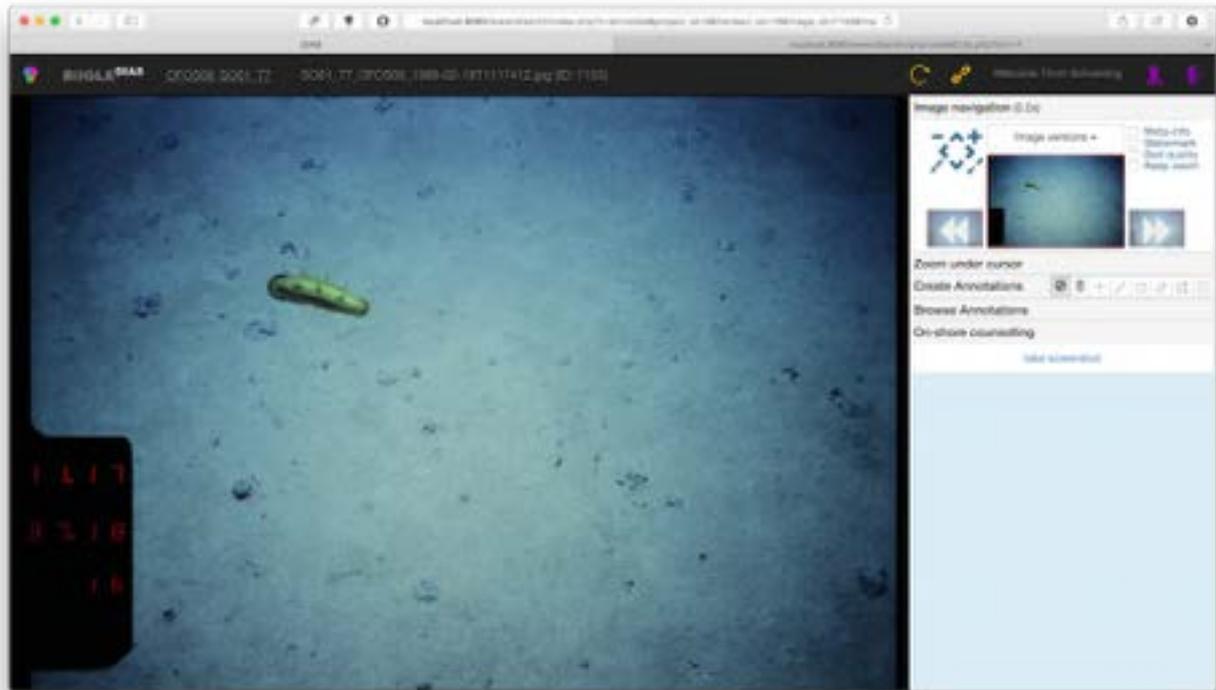
the transect of for the whole transect. In some cases, a region to be analysed has been marked in the images. This is what the second checkbox refers to. The last checkbox defines whether the exact x,y coordinates of each individual will be given in the CSV file or if for each image only the number of individuals is given. Finally, you can select for which annotations you want to export the annotation data.



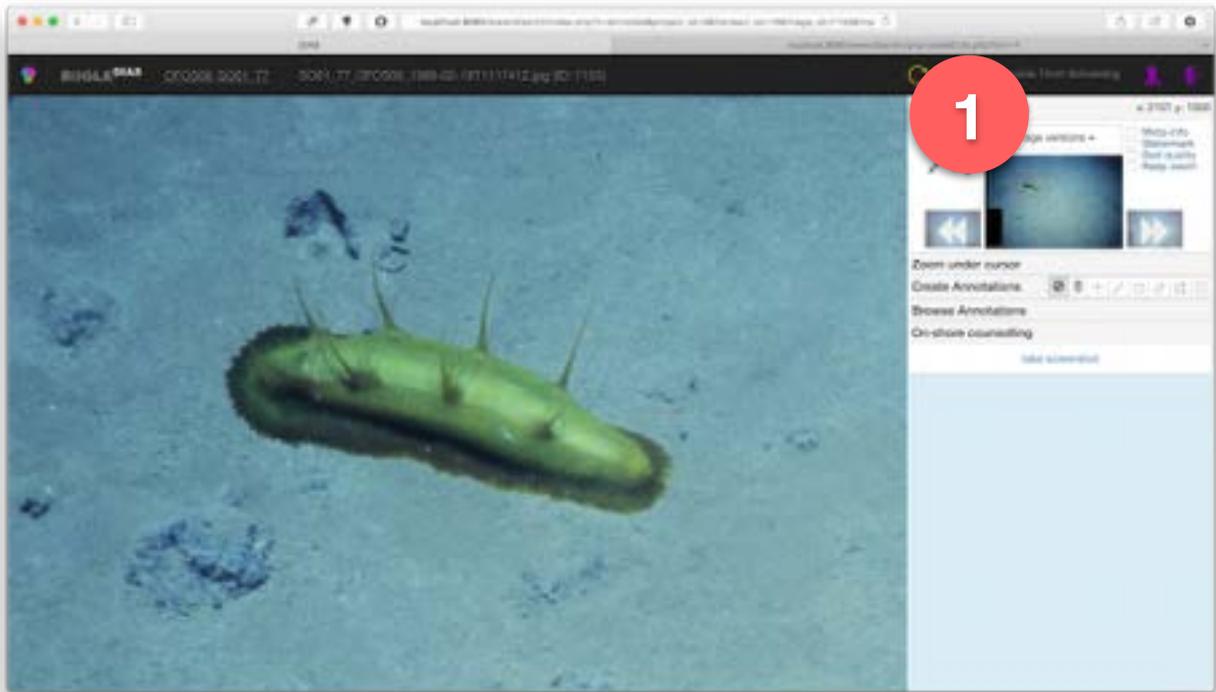
**Map view:** similar to the project map view, where each transect is marked by one point on the map, it is also possible to show the location of each image of one transect on a map. The prerequisite of this is of course, that the EXIF header of the image contains location data. Each red circle on the map represents one image. Moving the cursor on top of one of the points, shows the corresponding thumbnail. Clicking on the circle then shows the image in the annotation view.



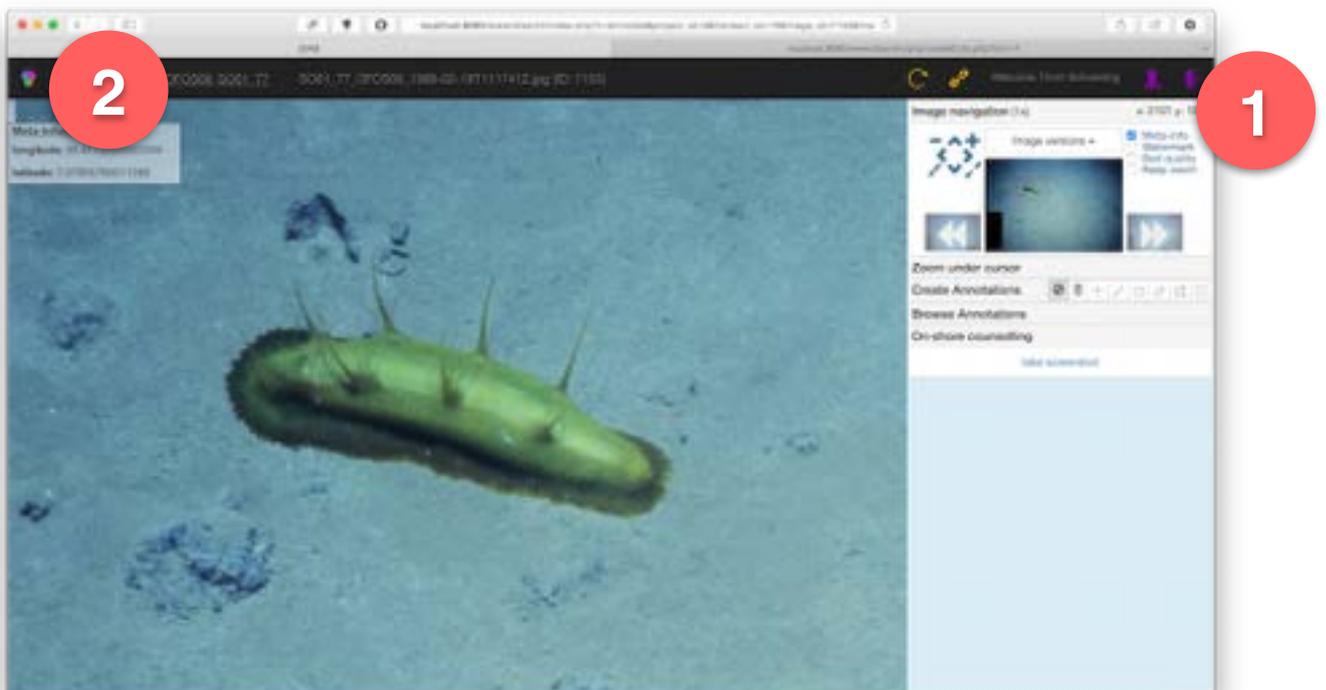
**Change map:** If no map image (and world file) has been uploaded, or if you want to change the underlying map, you can click on “change map” at the bottom of the page. A form is displayed to select from existing maps or upload a new map.



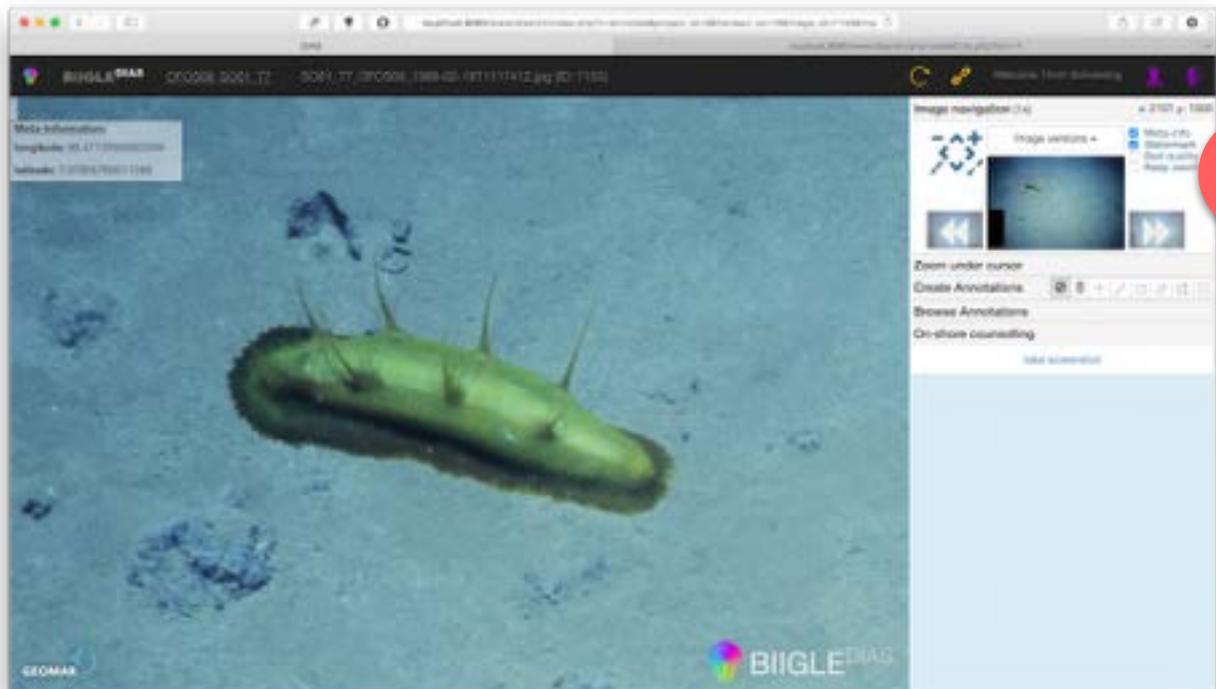
**Annotation view:** This is the main view to display and browse the full resolution images and to add semantic annotation data. The main, left part of the view is occupied by the image. To the right, the annotation toolbox is displayed with multiple tabs for different purposes. The top tab contains the image navigation. In the tab header, the current zoom-factor is displayed. Below that, buttons to zoom in and out (“+”,“-“) allow rescaling the image display. The arrow buttons move the currently visible part of the image towards the corresponding directions. The two buttons below, scale the image to zoom-factor 1 or to the zoom\_factor such that the whole image is visible. The drop-down again allows to show processed versions of the image. The checkboxes have mixed functionality. Meta-info and Watermark display additional information on top of the images (see below). The “Bad quality” checkbox is like annotating the whole image as not analysable, e.g. due to sediment plumes, failed flash, etc. Finally, buttons to move to the previous / next image are shown and, between those, a minimap that shows with a red frame where within the image the currently visible part is.



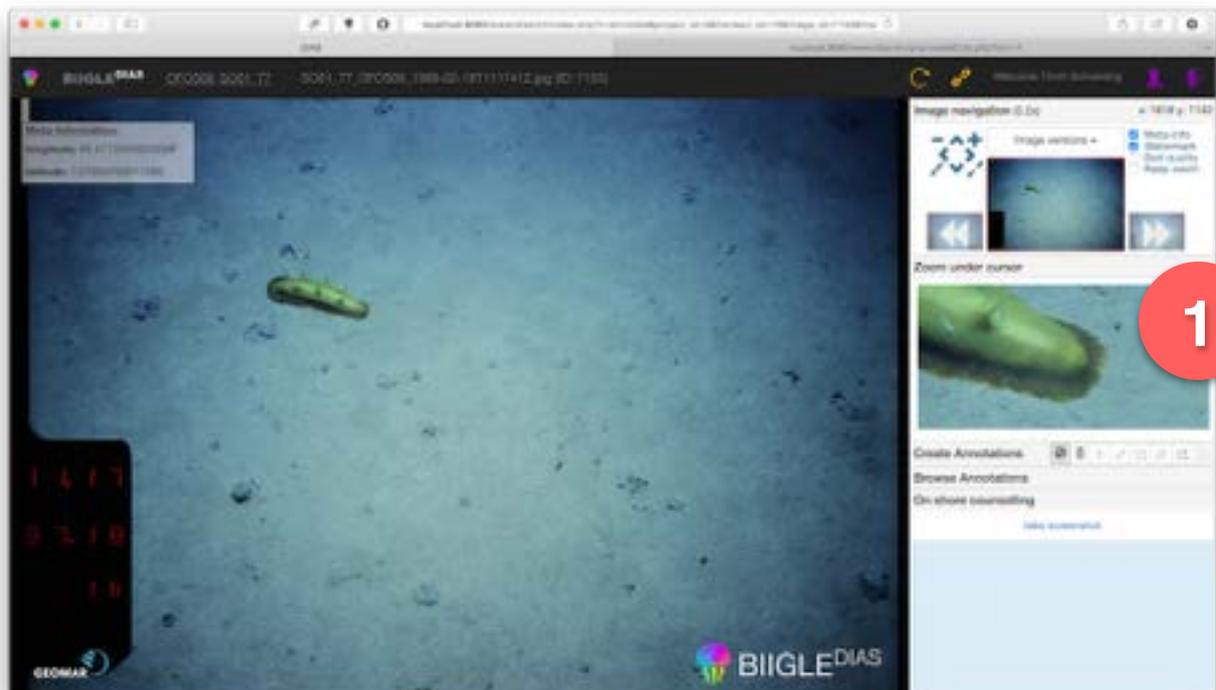
**Zooming in:** Here one part of the image has been zoomed in (i.e. through the buttons or through scrolling with the mouse wheel). Notice the red frame in the minimap (1). You can also click in this minimap or drag the red frame to navigate within the image.



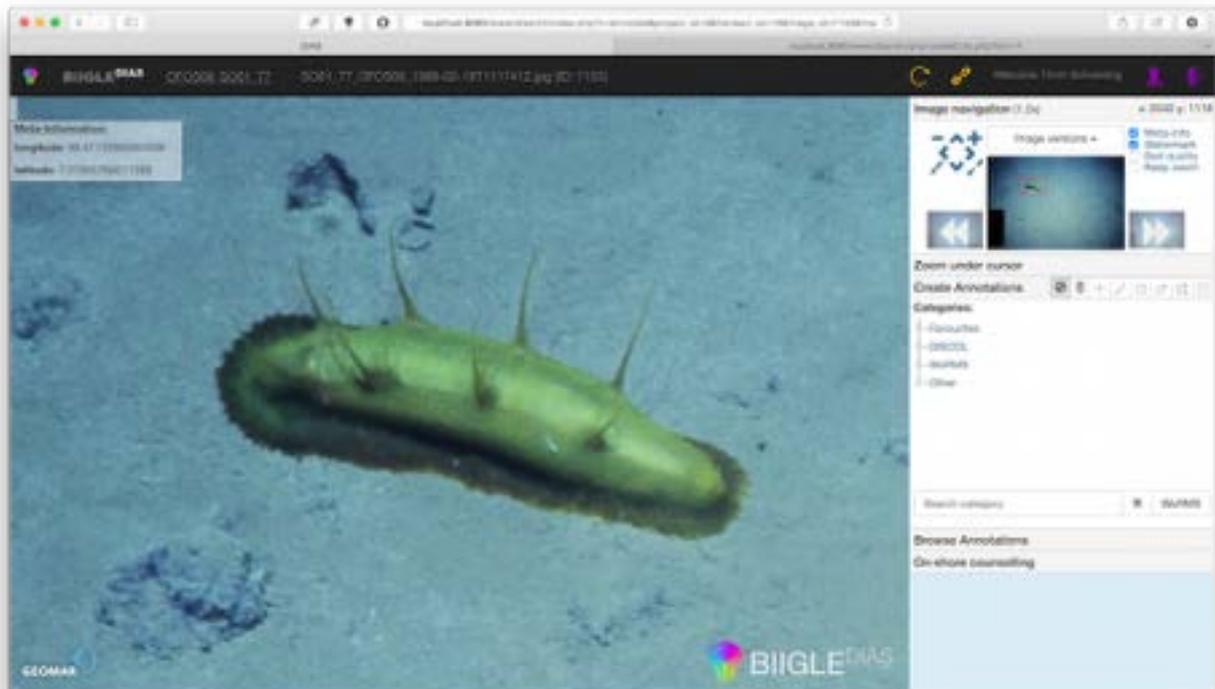
**Meta information:** Here the available meta-information are displayed in the top left of the image. The displaying of meta-information is activated by checking the box at (1). If the pixel to centimetre ratio for this image would be known, a scaling bar would also be displayed (2).



**Watermarks:** Display of the watermarks in the bottom corners of the image, one user-defined and one for the annotation software. Activated by checking the checkbox at (1).

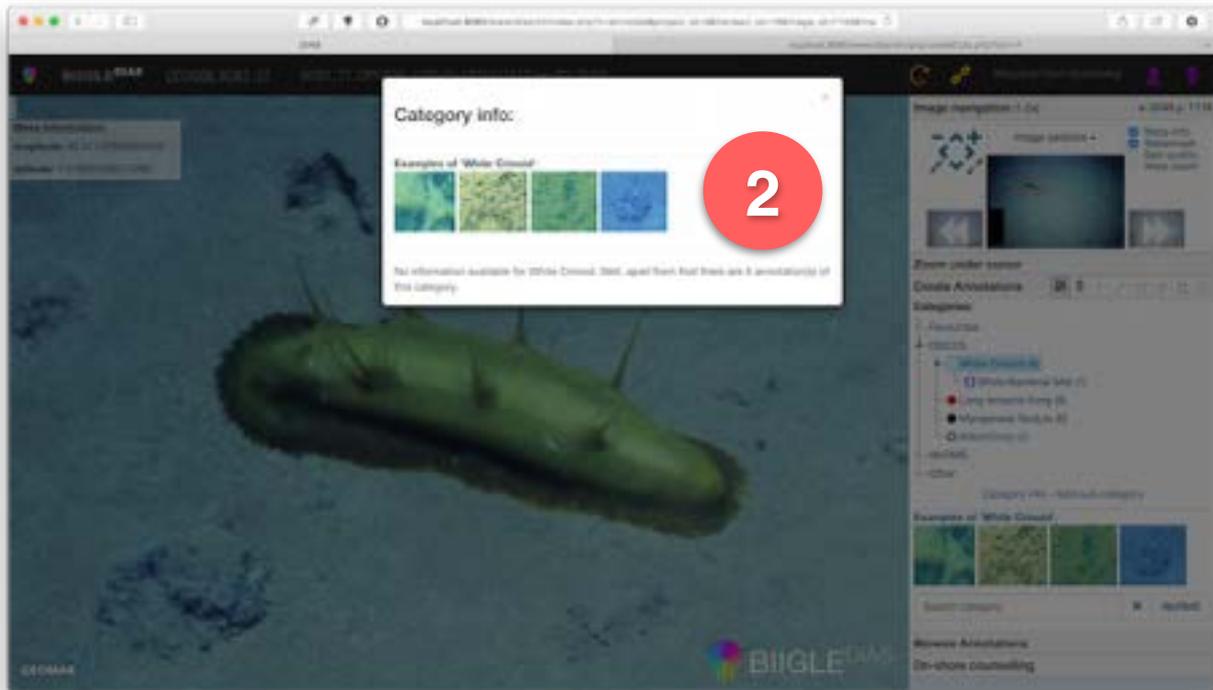


**Under cursor zoom:** Only in browsers it is possible to use this tool. By moving the mouse cursor across the image, a copy of the image is shown in the toolbox that has a zoom-factor of one so shows the original image resolution (1).

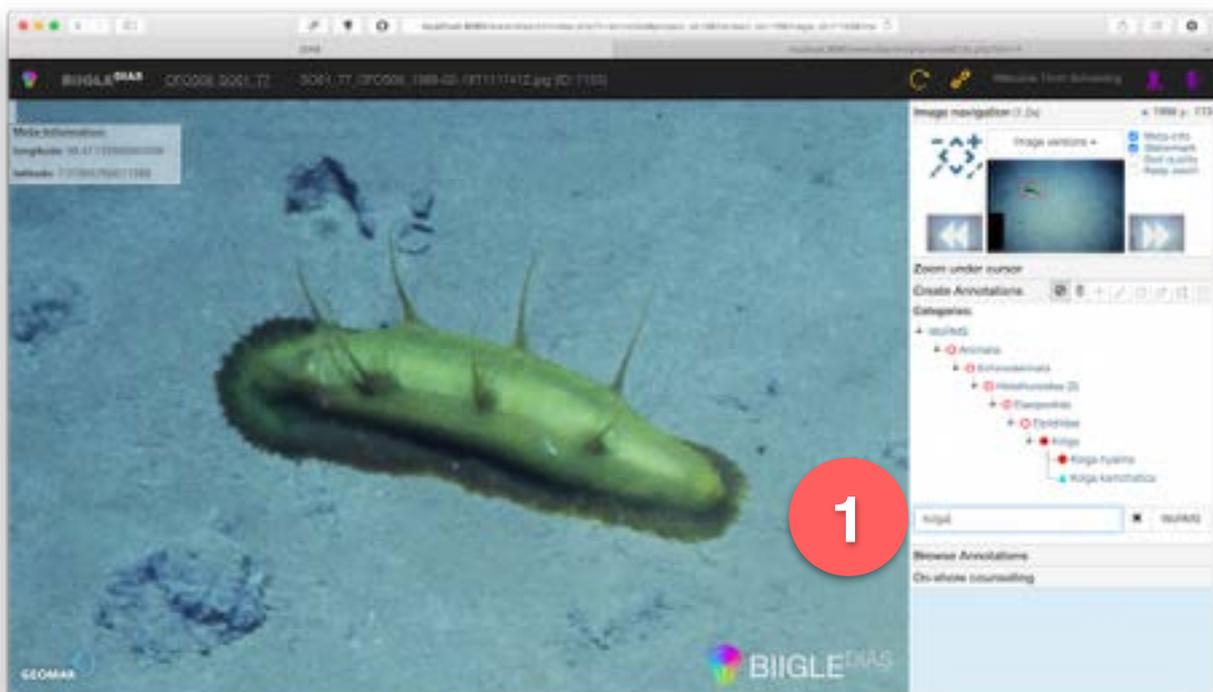


**Annotation toolbox:** Within this most important view, the annotation toolbox is the most important part, because here you can select the label (or “category”) for the classification step as well as the geometric marker (“point”, “line”, etc.) for the definition of the pixels to be annotated in the detection step.

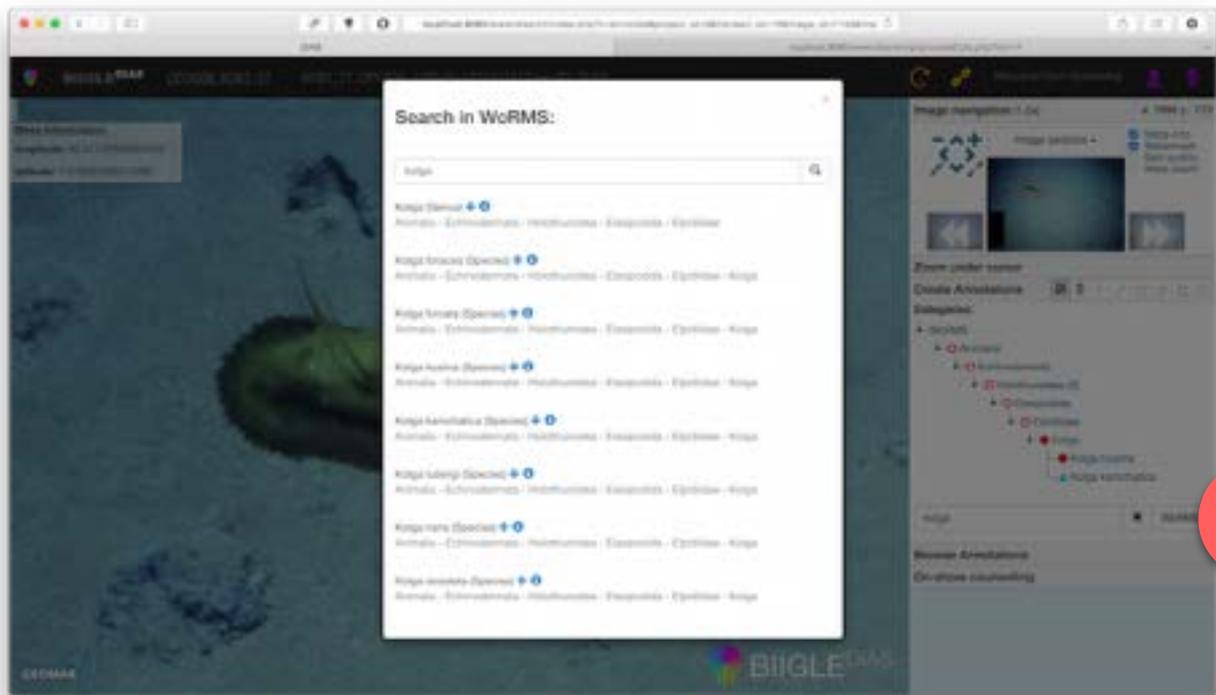
The geometric marker can be selected in the header of the toolbox. The first button is no marker. When this button is clicked, clicking and dragging with the mouse on the image will pan the visible part of the image. The second button is for deleting annotations (be careful what you do!). The following five buttons are for annotating: points, lines, rectangles, ellipses and polygons. The last button is a placeholder without functionality (if you are curious: it is for annotating tiles within the image, e.g. to manually annotate parts of an image with the coverage of manganese nodules). In the toolbox itself, a tree of categories is displayed. In this case, there are four different root categories: “Favourites” which contains the user specific set of categories she / he has used the most in the past. “DISCOL” that contains project specific categories, for example when it can’t be easily defined what is visible in the images. A typical category in this tree would be “Whitish anemone” and the idea is to later on discuss such project-specific categories and assign them to WoRMS categories. These WoRMS categories are contained in the following tree and each category in here represents a name from the phylogenetic tree and can be identified with an AphiaID. Not the complete WoRMS tree is available but categories from it can be added upon request (see below). Finally the last root tree contains “Other” categories like abiotic factors (“Lebensspuren”, “Cobble”, “Pebble” but also “Laserpoints” and else).



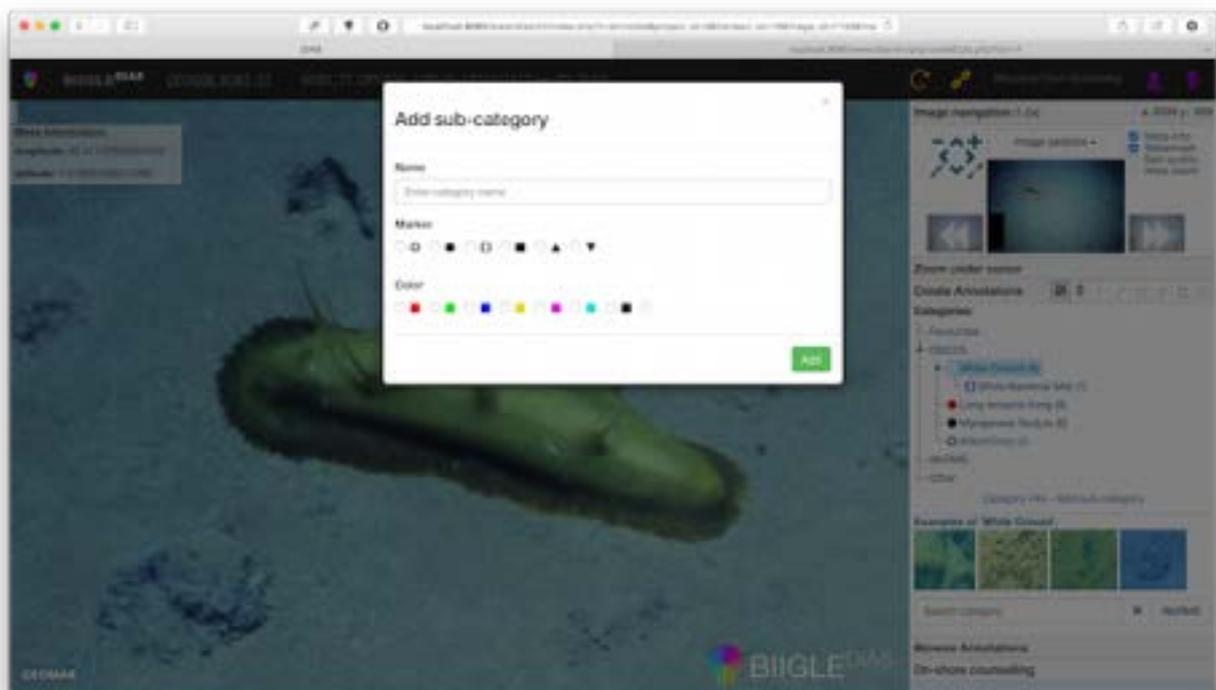
**Category info:** Whenever you select one category from the category tree, DIAS tries to find examples for this category within the existing annotations. These examples will be displayed (1) for a rapid and easy assessment whether your idea of what you think an object is, is actually true. You can also click on the “Category info” link to see more information about the object (2).



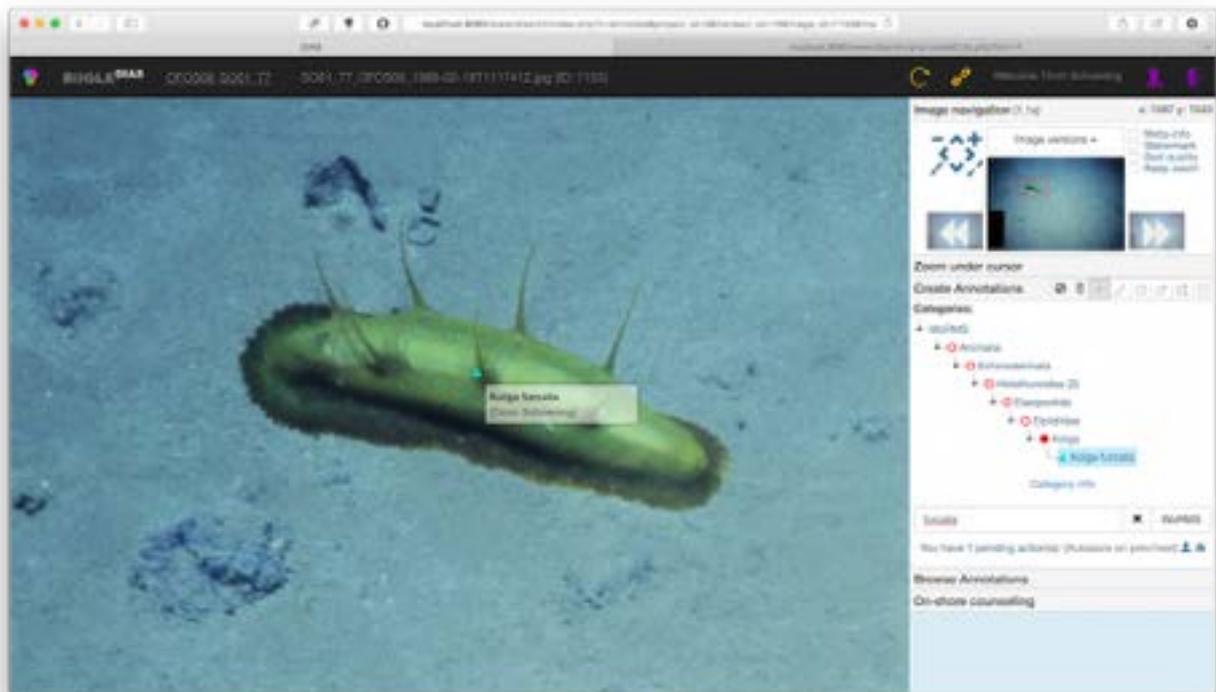
**Search category:** There is a search field (1) where you can search the complete category tree for a name. Only those categories that match that name will be retained in the tree (and their parents and ancestors of course).



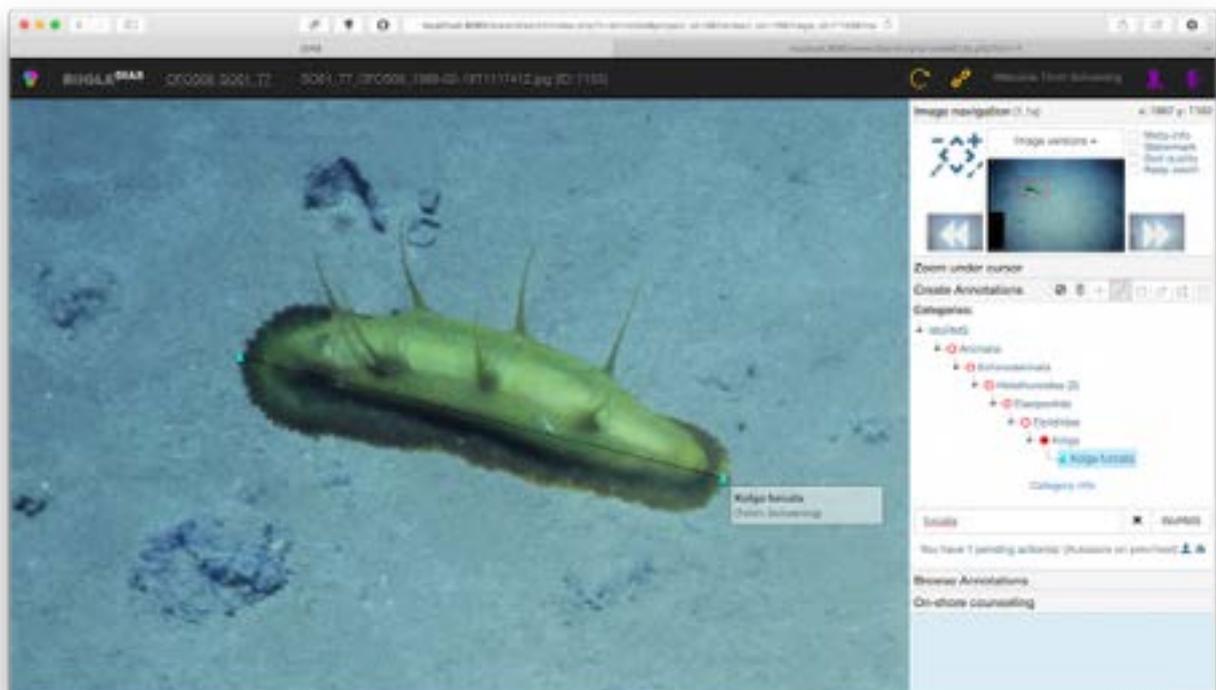
**Searching in WoRMS:** The WoRMS database can be queried directly from DIAS. In case you could not find a category you were looking for, you can also try to find it in WoRMS by clicking on the WoRMS button (1). This search requires an internet connection! If the category name is contained in WoRMS you can add it to the DIAS category tree by clicking on the “+” icon behind the name. Afterwards you can pick an icon and a colour for the category markers.



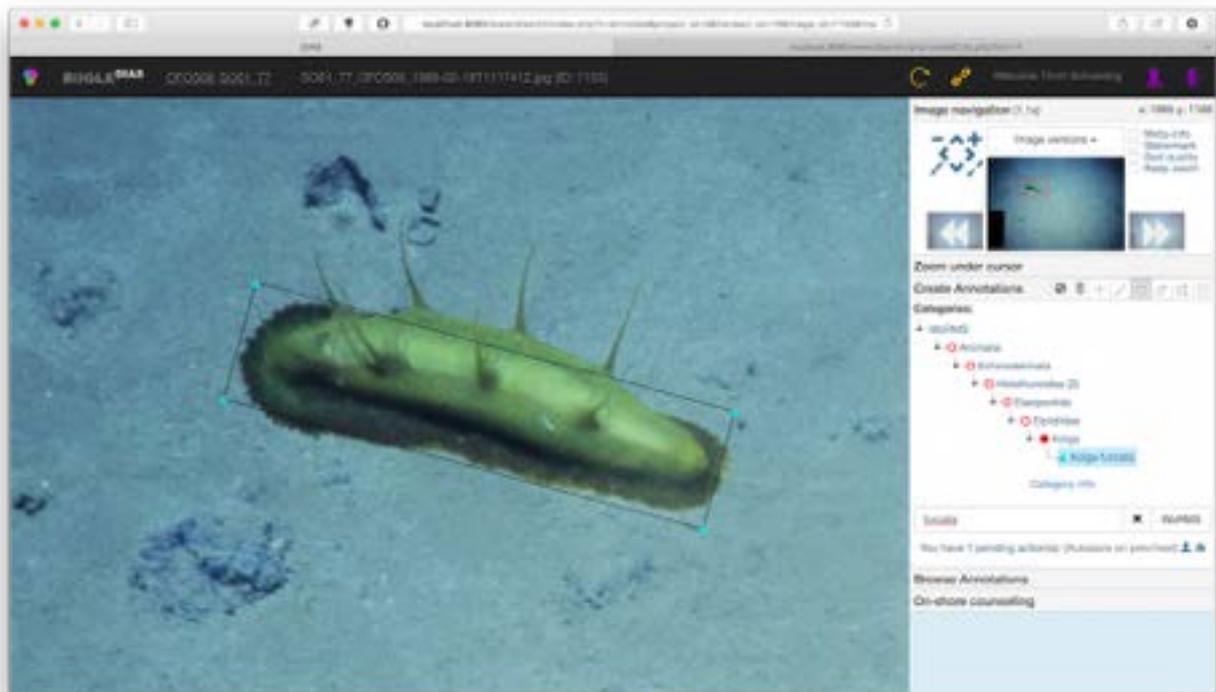
**Adding a category:** You can only freely modify the project-specific categories. For that tree, you can add arbitrary sub-categories wherever you like with arbitrary names and also assign a marker icon and colour to it.



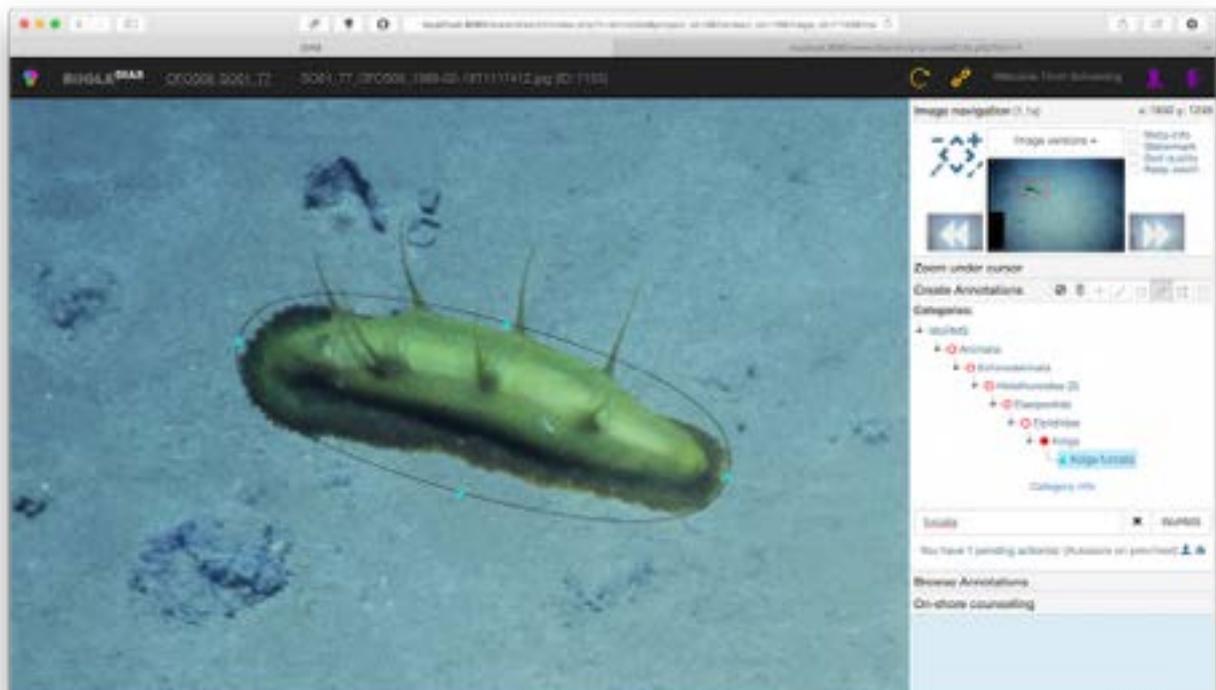
**Point marker:** Annotating points is the easiest way to add semantic to images. But be aware, that points provide you only with presence / absence data! For (bio)mass assessments, you need at least the length or diameter of an object.



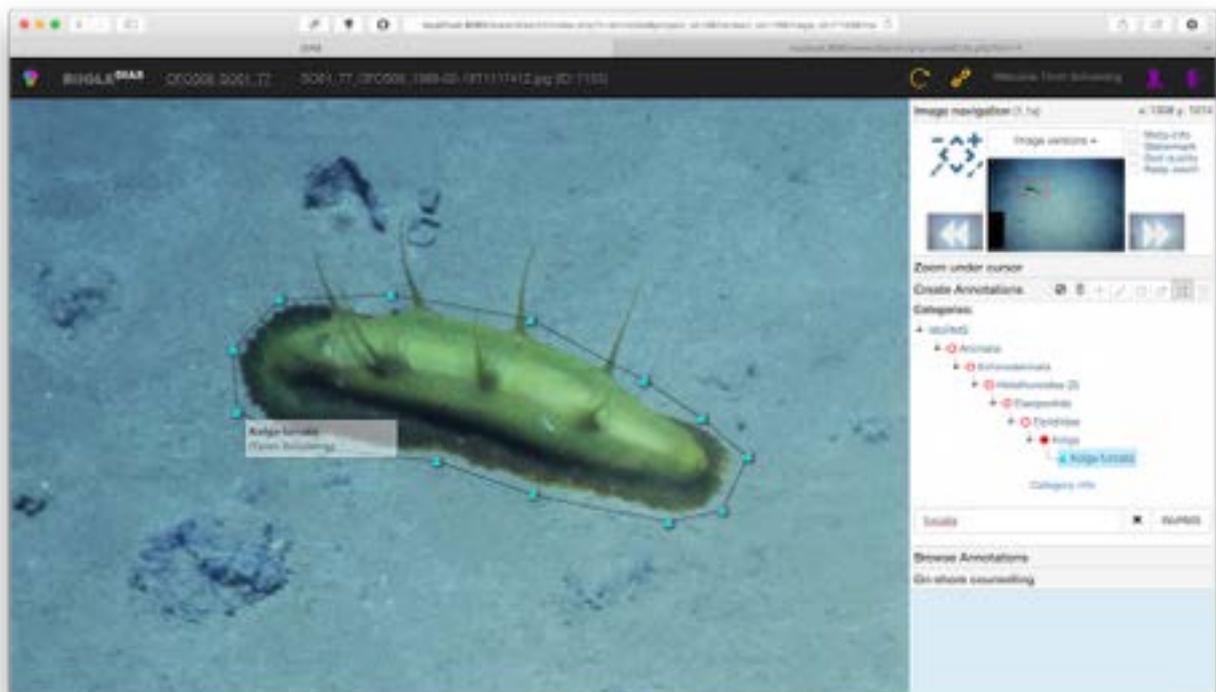
**Line marker:** Lines can be annotated in DIAS by clicking at the first position (i.e. mouse button down and up at the start location), then moving the cursor to the end location and clicking again. It is **not** mouse down, move, mouse up!



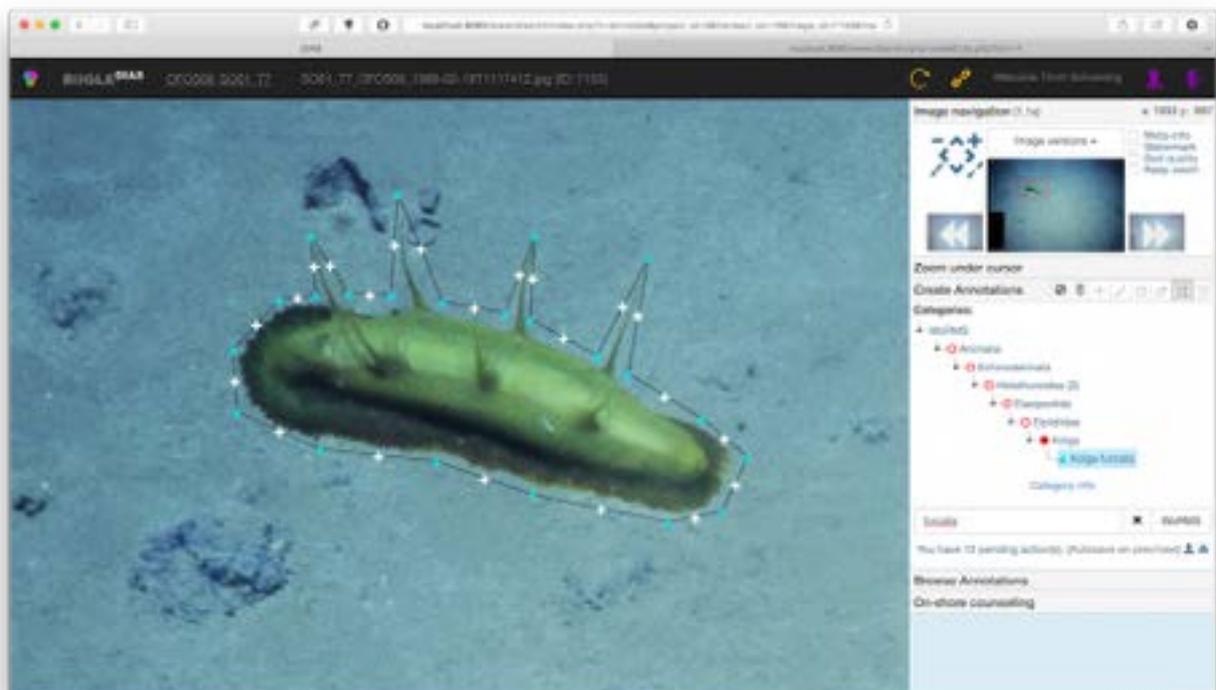
**Rectangle marker:** Rectangles are also annotated by three clicks. In this case, the first click marks one corner of the rectangle. Moving the mouse cursor then creates one of the sides of the rectangle. A second click defines the second corner. Moving the mouse again then created the second side, perpendicular to the first. The final, third click then fully defines the rectangle.



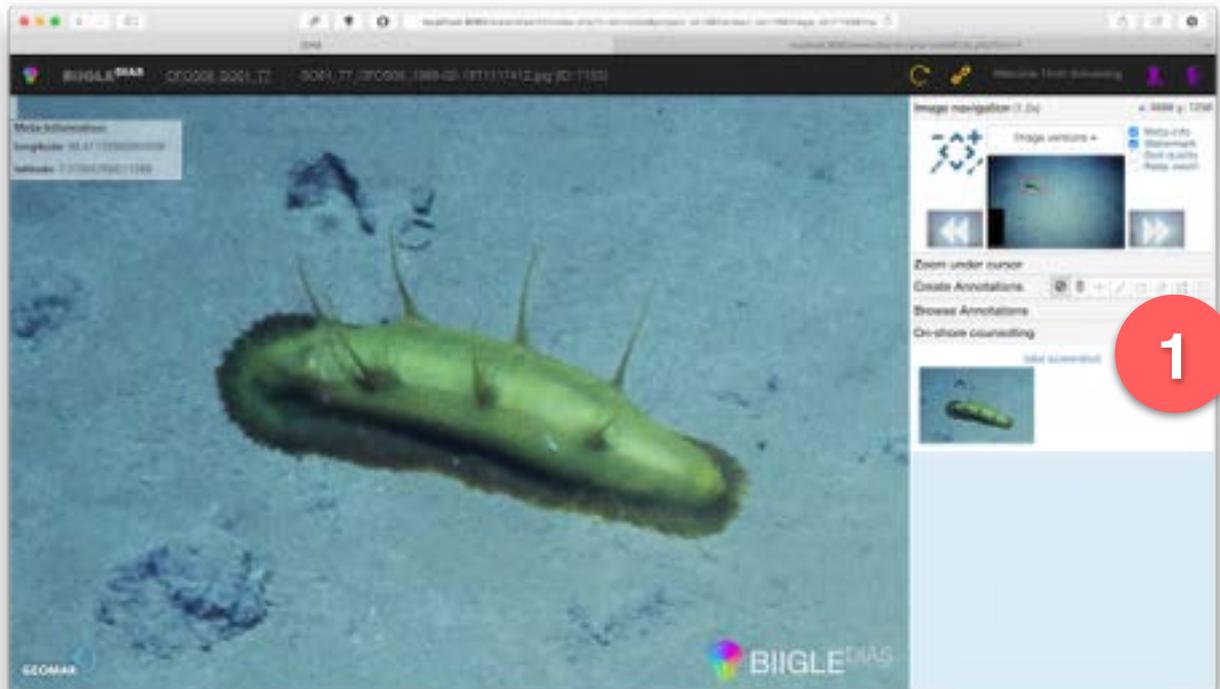
**Ellipse marker:** Ellipses are created similar to rectangles with three clicks. In this case though, the lines define the main diagonals of the ellipse.



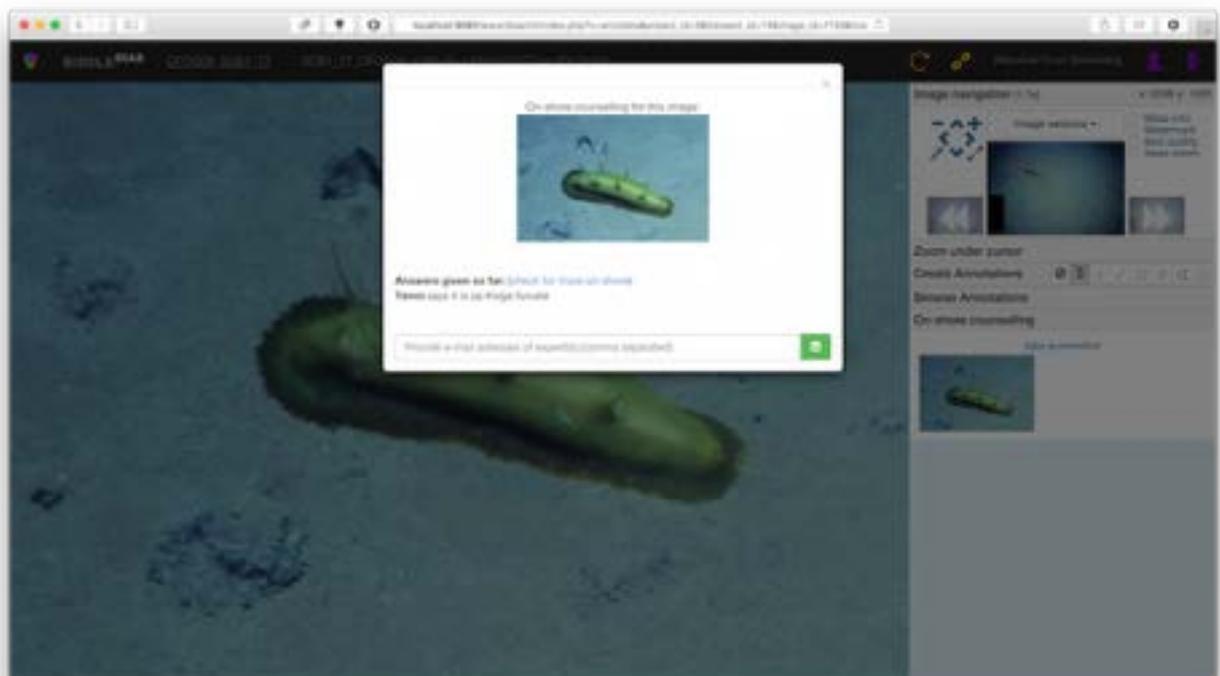
**Polygon marker:** Polygons are the most complex way of annotating but also provide the most detail. Each click creates another marker. Clicking on one of the icons completes the annotation process.



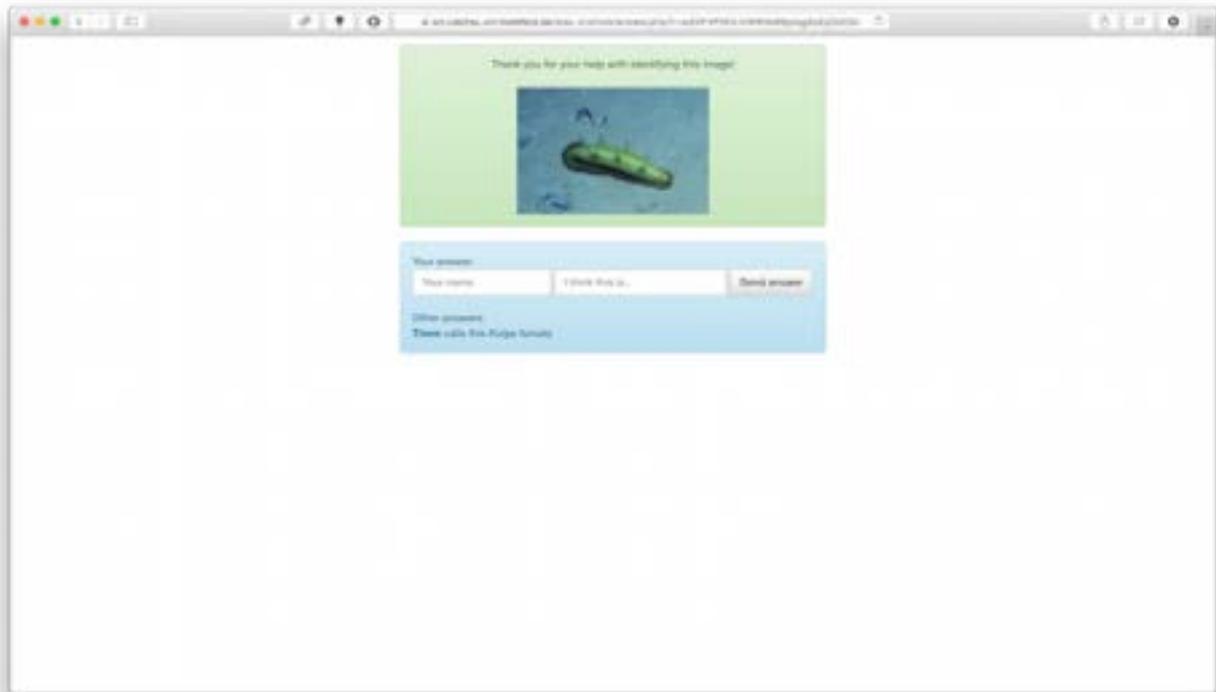
**Modifying annotations:** For a finished annotation, you can click on any of the icons to get additional controls to modify the annotation shape. Dragging the icons thereby has different effects. The plus signs between the icons of a polygon e.g. create further icons in between to increase the detail of the polygon outline.



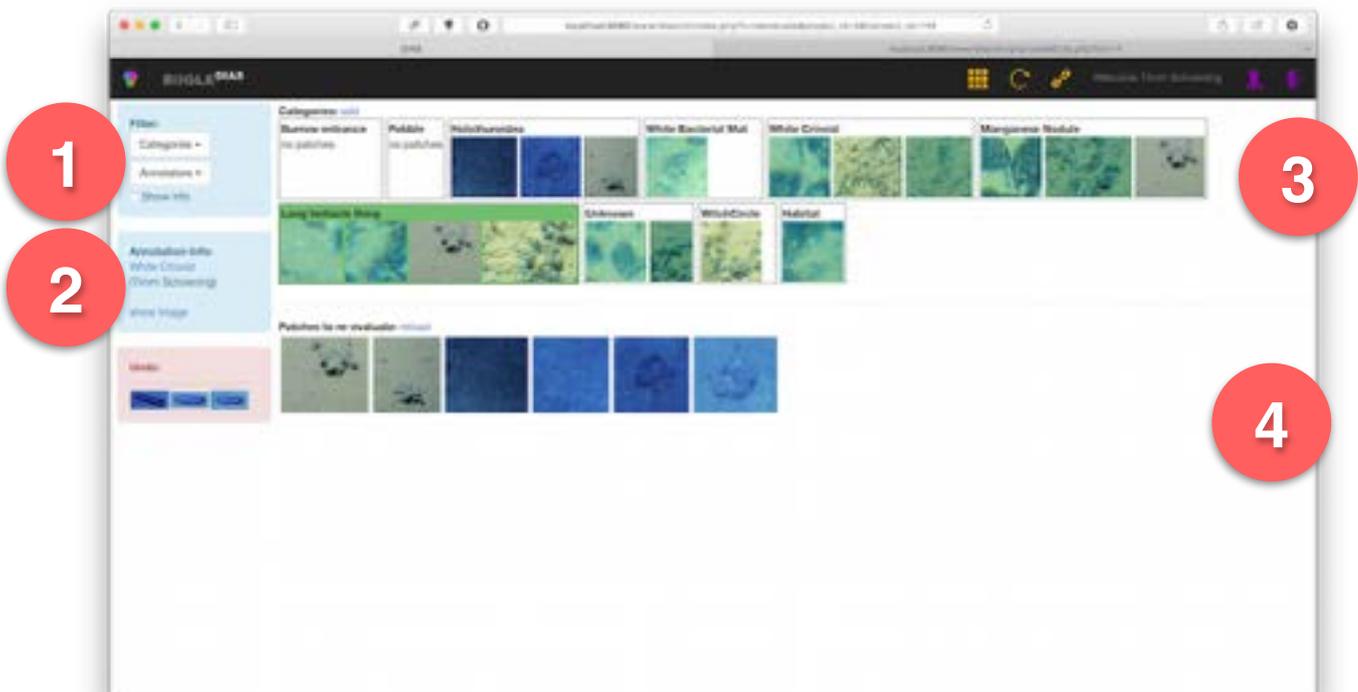
**Onshore counselling:** In case you are not sure what an object is, but you think there is someone else who might know, you can query for help. Clicking on the screenshot button (1) will send a minified version of the currently visible part of the image to the DIAS server in Bielefeld. This minified screenshot is also displayed here for further inspection.



**Counselling details:** A click on the screenshot opens a form where you can browse possible answers and also send the counselling request to your colleagues. Each counselling can be identified by a cryptic string and only through a distinct URL can onshore experts see the request.



**Counselling:** The page that the users sees through the link looks like above. The screenshot is shown and a form to add a name and a suggestion what it might be. The counsellor does not have to have a DIAS account.



**Reevaluation:** In DIAS it is possible to label existing annotations to rapidly provide more reliable annotations. When several users annotate the same object with the same label, it is more likely that this annotation is actually correct. **NEVER(!!!)** rely on the annotations of only one expert. Experts make severe mistakes. You are no exception!

In the reevaluation view, you see a navigation to the left where you can filter the annotations of a transect by the expert who annotated and / or by the categories that have been assigned to annotations (1). Below that (2), information on an annotation can be displayed but the checkbox above has to be checked for that! The final, red, box eventually contains reevaluated annotations. In case you made a mistake during reevaluation, you can undo that here by clicking on the image patch.

To the right, there are at first some categories with example image patches (3). You can add further categories from the DIAS category trees by clicking on the “add” button. When you click on one of the categories, it is highlighted in green. When you now click on one of the annotation patches below (4), this annotation is stored in the database as an annotation under your name with the same geometric shape as it was before. The label that is assigned to this annotation is the one you selected above, i.e. the highlighted one. By filtering the annotations with the drop-downs to the left, you can rapidly browse annotations by other users and validate or falsify them.