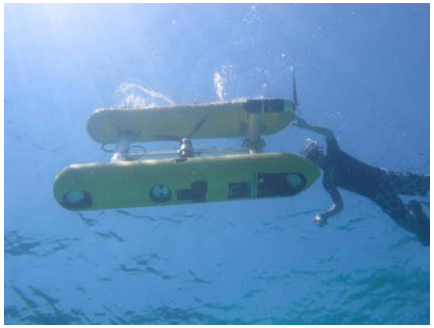
Using the NeCTAR research cloud to develop national on-line services to annotate and analyse underwater imagery: SQUIDLE+ and GlobalArchive

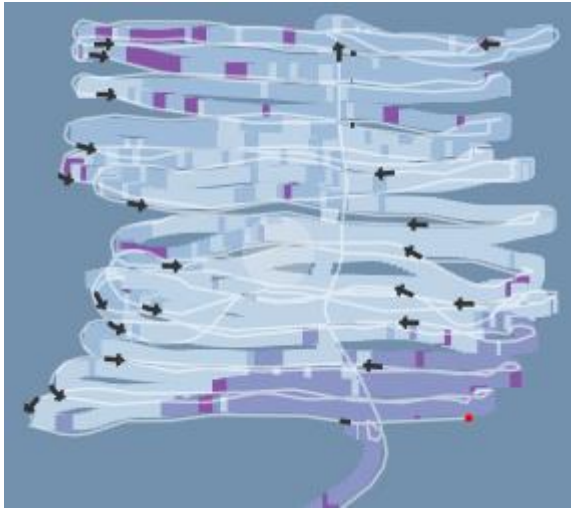
Roger Proctor (AODN),
Tim Langlois (UWA), Ariell Friedman (Greybits),
Brendan Davey (TPAC)

Why is imagery important?

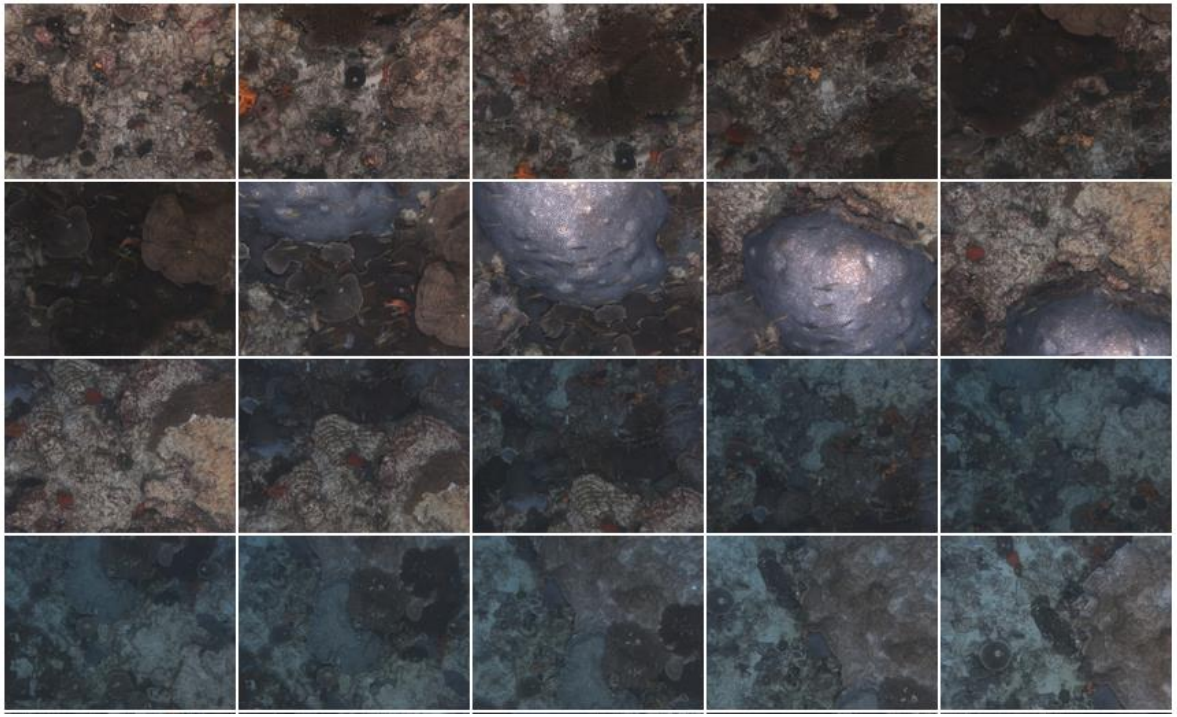
- Imagery fast becoming a tool of choice of State of Environment Reporting
- Enables fast, ‘cheap’ repeat sampling to assess health of area
- World-wide interest in its use
- Video == BIG DATA, laborious workflow, mostly desktop
- Because mostly desktop, sharing is difficult
- Cloud can address this and improve efficiency and uptake

IMOS Autonomous Underwater Vehicle





30,000 Stereo images of benthos in typically 50m x 50m square



Stereo BRUV data collection

Deploying the BRUV
Baited Remote Underwater Video

Deployments typically last an hour
Aim: identify local fish population

Australian Community Cloud funded by Nectar

Marine Sciences Cloud – IMOS, Ecosystems Science Cloud – TERN, Biosciences Cloud – Bioplatforms Australia

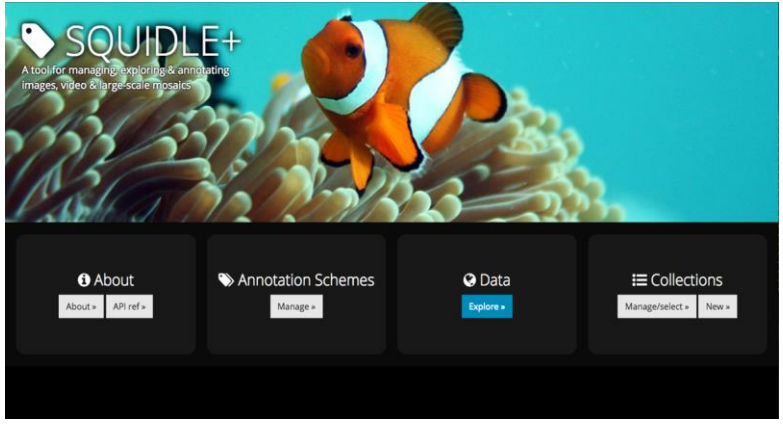
Marine Sciences Cloud has two components:

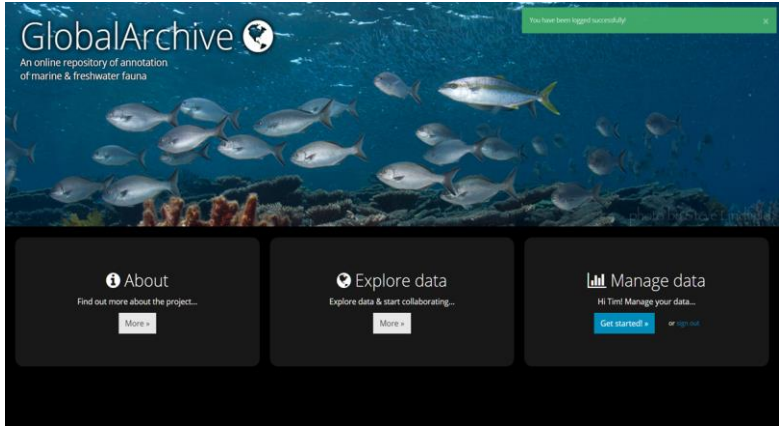
National services to annotate and analyse underwater imagery by leveraging existing software initiatives:

- **Squidle+**: exploration, management and annotation of georeferenced images & video
- **GlobalArchive**: exploration, sharing and querying of annotation data

Virtual desktop support for marine and climate scientists

- Researchers can run analyses using a suite of online graphical and scripting tools (eg: Jupyter notebook, QGIS Browser, Rstudio, Panoply)
- Links to data repositories





Developed & maintained by Ariell Friedman (Greybits Engineering)
With support from SOI, IMOS and the Nectar Science Cloud

Key features of SQUIDLE+

Flexible data storage:

Sync with existing data storage infrastructure (i.e.: data linked from AODN). Avoids needing to copy and duplicate data. Takes minutes instead of days to import data into the system.

Flexible, translatable annotation schemes:

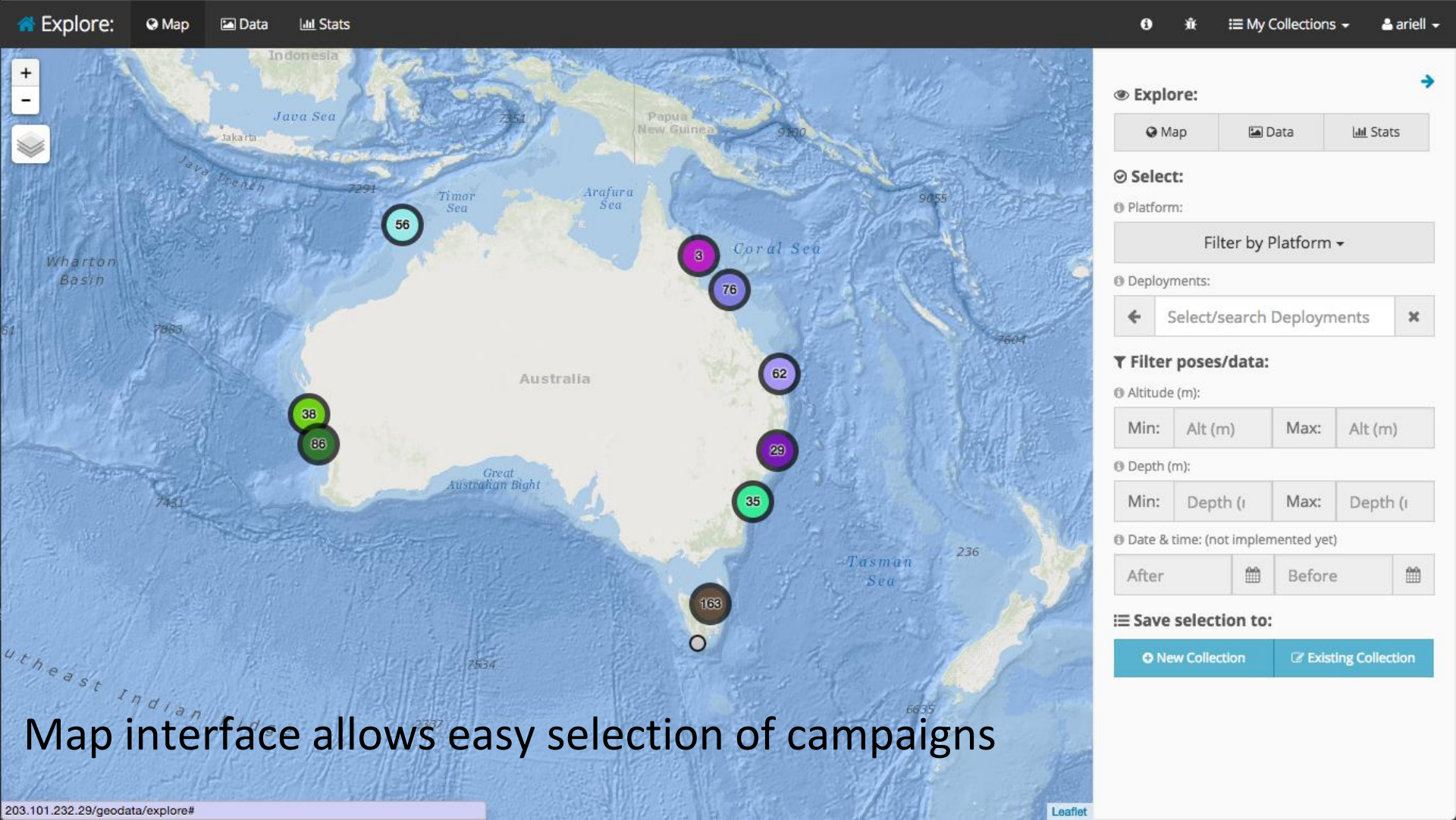
Users can define their own annotation schemes or select from existing ones, and can translate between them meaning all annotations can be viewed in a unified consistent framework

Collaborative / automated labeling

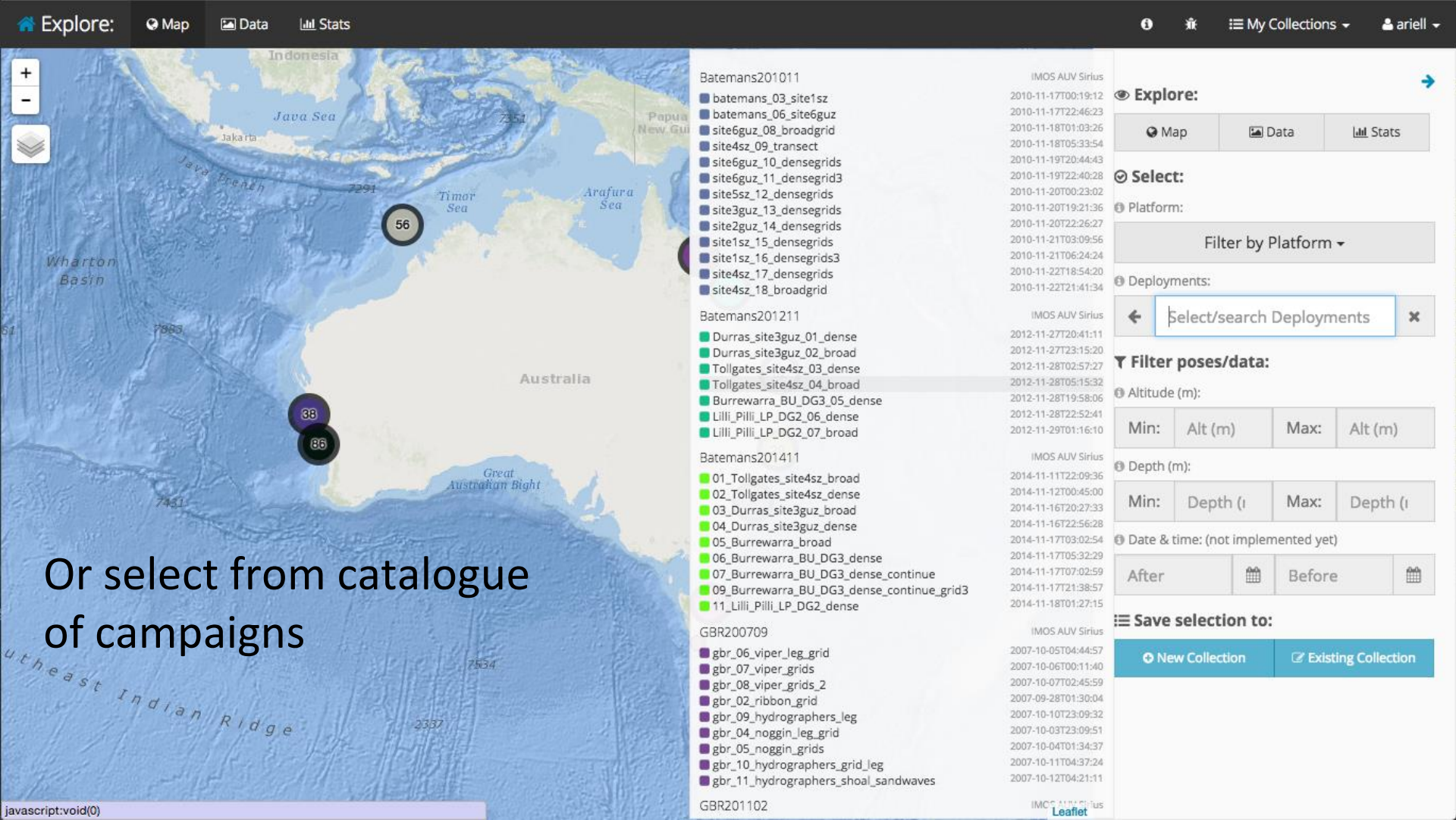
Data can be annotated by different users with different skill levels and automated algorithms can be called upon to speed up the annotation process.

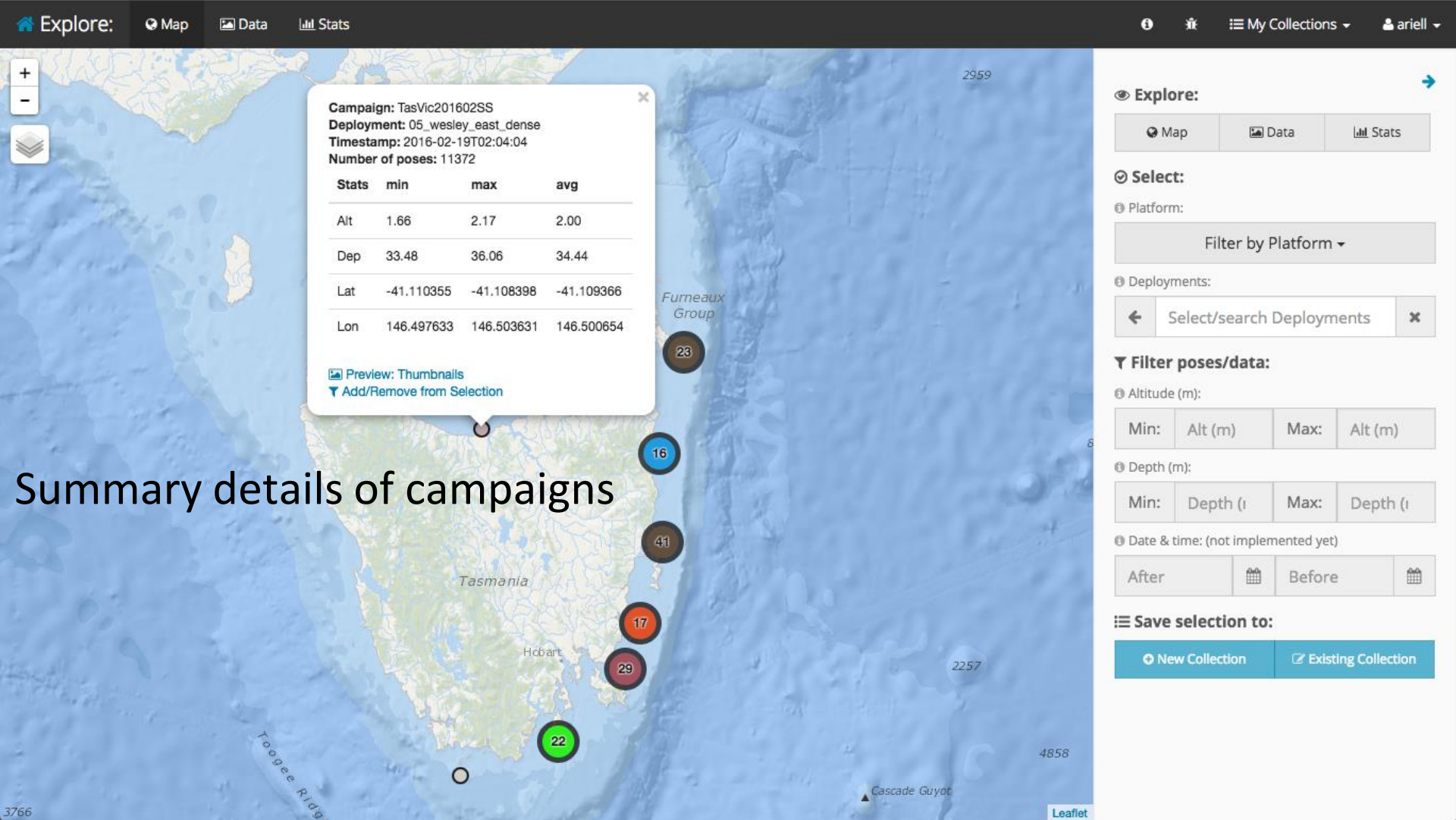
"Media object" annotation

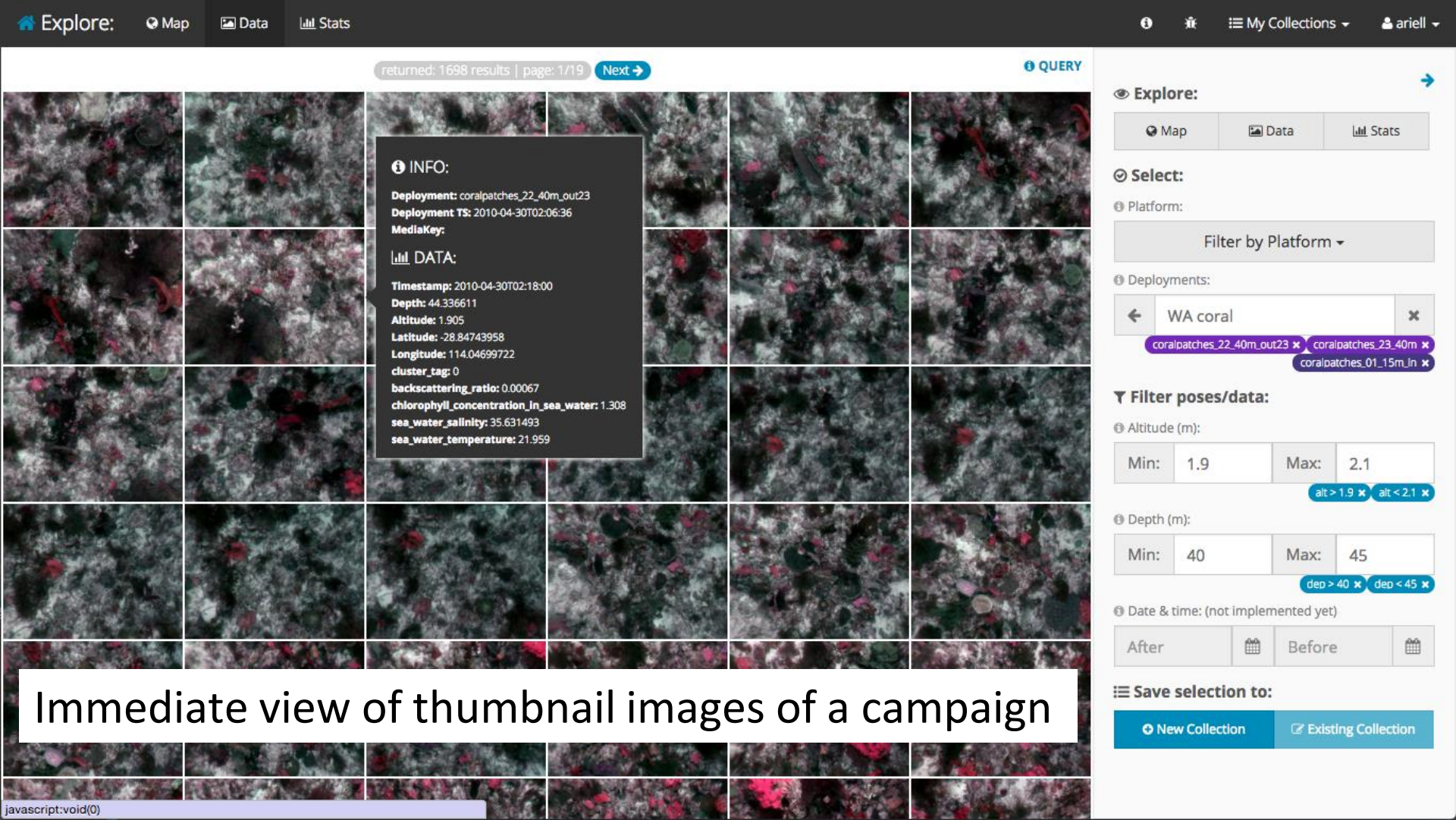
Images, videos, mosaics, etc can all be annotated using the same consistent framework.

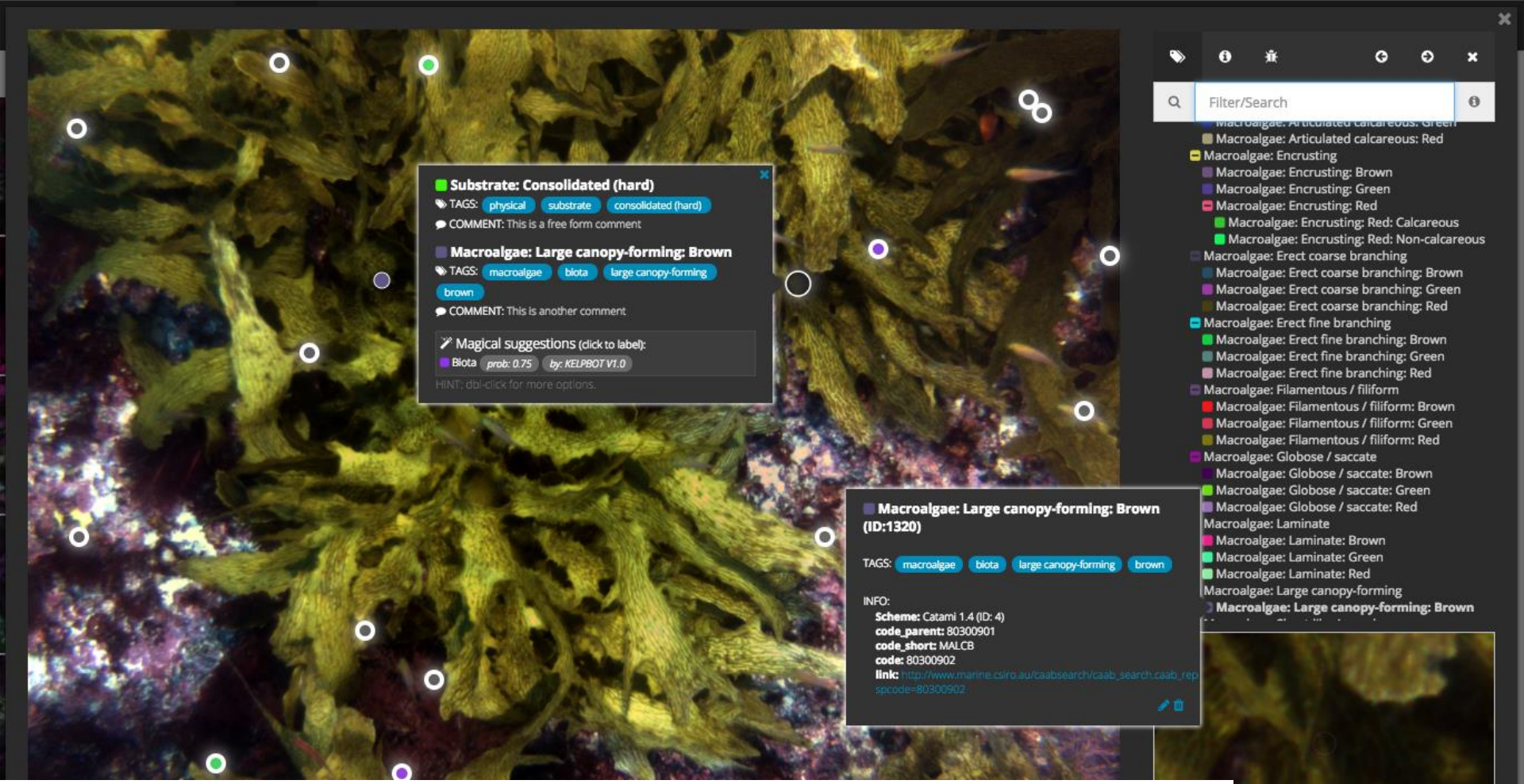


Map interface allows easy selection of campaigns

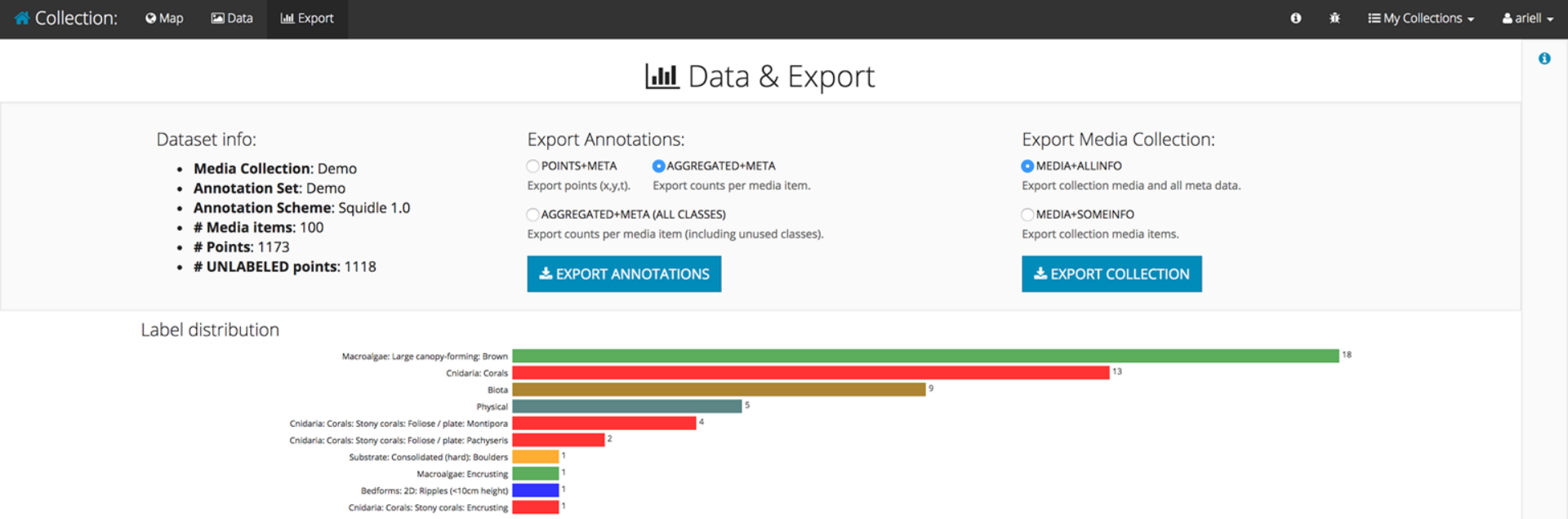

Explore:
Map
Data
Stats
My Collections
ariell
Indonesia
Java Sea
Jakarta
Java Trench
Timor Sea
Arafura Sea
Wharton Basin
Australia
Great Australian Bight
Southeast Indian Ridge
7351
7291
7883
7431
7534
2387
56
38
86
Batemans201011
IMOS AUV Sirius
batemans_03_site1sz 2010-11-17T00:19:12
batemans_06_site6guz 2010-11-17T22:46:23
site6guz_08_broadgrid 2010-11-18T01:03:26
site4sz_09_transect 2010-11-18T05:33:54
site6guz_10_densegrids 2010-11-19T20:44:43
site6guz_11_densegrid3 2010-11-19T22:40:28
site5sz_12_densegrids 2010-11-20T00:23:02
site3guz_13_densegrids 2010-11-20T19:21:36
site2guz_14_densegrids 2010-11-20T22:26:27
site1sz_15_densegrids 2010-11-21T03:09:56
site1sz_16_densegrids3 2010-11-21T06:24:24
site4sz_17_densegrids 2010-11-22T18:54:20
site4sz_18_broadgrid 2010-11-22T21:41:34
Batemans201211
IMOS AUV Sirius
Durras_site3guz_01_dense 2012-11-27T20:41:11
Durras_site3guz_02_broad 2012-11-27T23:15:20
Tollgates_site4sz_03_dense 2012-11-28T02:57:27
Tollgates_site4sz_04_broad 2012-11-28T05:15:32
Burrewarra_BU_DG3_05_dense 2012-11-28T19:58:06
Lilli_Pilli_LP_DG2_06_dense 2012-11-28T22:52:41
Lilli_Pilli_LP_DG2_07_broad 2012-11-29T01:16:10
Batemans201411
IMOS AUV Sirius
01_Tollgates_site4sz_broad 2014-11-11T22:09:36
02_Tollgates_site4sz_dense 2014-11-12T00:45:00
03_Durras_site3guz_broad 2014-11-16T20:27:33
04_Durras_site3guz_dense 2014-11-16T22:56:28
05_Burrewarra_broad 2014-11-17T03:02:54
06_Burrewarra_BU_DG3_dense 2014-11-17T05:32:29
07_Burrewarra_BU_DG3_dense_continue 2014-11-17T07:02:59
09_Burrewarra_BU_DG3_dense_continue_grid3 2014-11-17T21:38:57
11_Lilli_Pilli_LP_DG2_dense 2014-11-18T01:27:15
GBR200709
IMOS AUV Sirius
gbr_06_viper_leg_grid 2007-10-05T04:44:57
gbr_07_viper_grids 2007-10-06T00:11:40
gbr_08_viper_grids_2 2007-10-07T02:45:59
gbr_02_ribbon_grid 2007-09-28T01:30:04
gbr_09_hydrographers_leg 2007-10-10T23:09:32
gbr_04_noggin_leg_grid 2007-10-03T23:09:51
gbr_05_noggin_grids 2007-10-04T01:34:37
gbr_10_hydrographers_grid_leg 2007-10-11T04:37:24
gbr_11_hydrographers_shoal_sandwaves 2007-10-12T04:21:11
GBR201102
Explore:
Map
Data
Stats
Select:
Platform:
Filter by Platform
Deployments:
Select/search Deployments
Filter poses/data:
Altitude (m):
Min:
Alt (m)
Max:
Alt (m)
Depth (m):
Min:
Depth (
Max:
Depth (
Date & time: (not implemented yet)
After
Before
Save selection to:
New Collection
Existing Collection
Leaflet
Or select from catalogue of campaigns
javascript:void(0)


Explore:
Map
Data
Stats
My Collections
ariell
Campaign: TasVic201602SS
Deployment: 05_wesley_east_dense
Timestamp: 2016-02-19T02:04:04
Number of poses: 11372
Stats min max avg
Alt 1.66 2.17 2.00
Dep 33.48 36.06 34.44
Lat -41.110355 -41.108398 -41.109366
Lon 146.497633 146.503631 146.500654
Preview: Thumbnails
Add/Remove from Selection
Summary details of campaigns
Furneaux Group
Tasmania
Hobart
Toogee Ridge
Cascade Guyot
2959
2257
4858
3766
23
16
41
17
29
22
Explore:
Map
Data
Stats
Select:
Platform:
Filter by Platform
Deployments:
Select/search Deployments
Filter poses/data:
Altitude (m):
Min:
Alt (m)
Max:
Alt (m)
Depth (m):
Min:
Depth (
Max:
Depth (
Date & time: (not implemented yet)
After
Before
Save selection to:
New Collection
Existing Collection
Leaflet

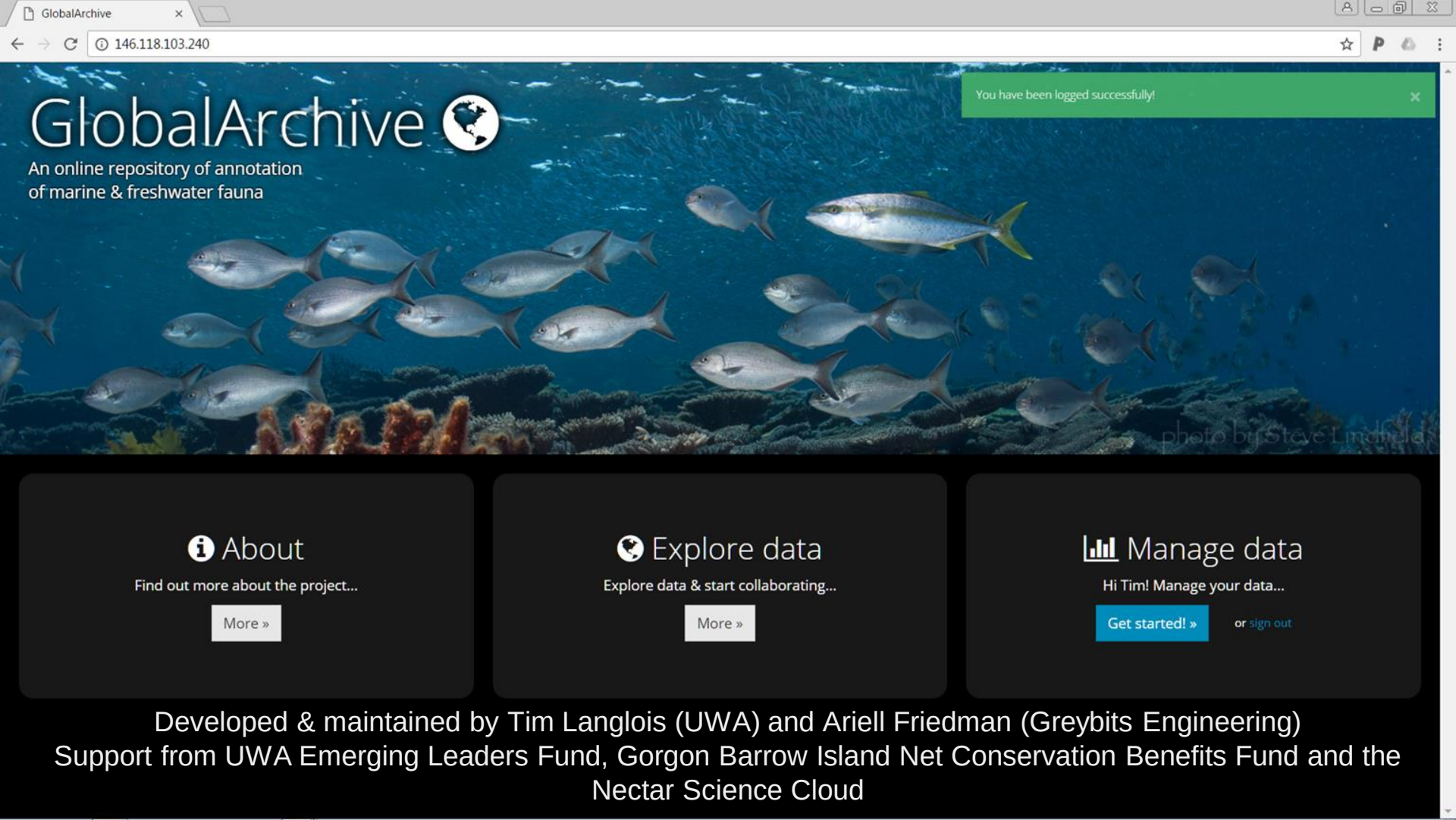

Explore:
Map
Data
Stats
My Collections
ariell
returned: 1698 results | page: 1/19
Next
QUERY
INFO:
Deployment: coralpatches_22_40m_out23
Deployment TS: 2010-04-30T02:06:36
MediaKey:
DATA:
Timestamp: 2010-04-30T02:18:00
Depth: 44.336611
Altitude: 1.905
Latitude: -28.84743958
Longitude: 114.04699722
cluster_tag: 0
backscattering_ratio: 0.00067
chlorophyll_concentration_in_sea_water: 1.308
sea_water_salinity: 35.631493
sea_water_temperature: 21.959
Explore:
Map
Data
Stats
Select:
Platform:
Filter by Platform
Deployments:
WA coral
coralpatches_22_40m_out23
coralpatches_23_40m
coralpatches_01_15m_in
Filter poses/data:
Altitude (m):
Min:
1.9
Max:
2.1
alt > 1.9
alt < 2.1
Depth (m):
Min:
40
Max:
45
dep > 40
dep < 45
Date & time: (not implemented yet)
After
Before
Save selection to:
New Collection
Existing Collection
Immediate view of thumbnail images of a campaign
javascript:void(0)



Point and click annotation – choice of annotation schemes



Export summary annotation details of campaigns

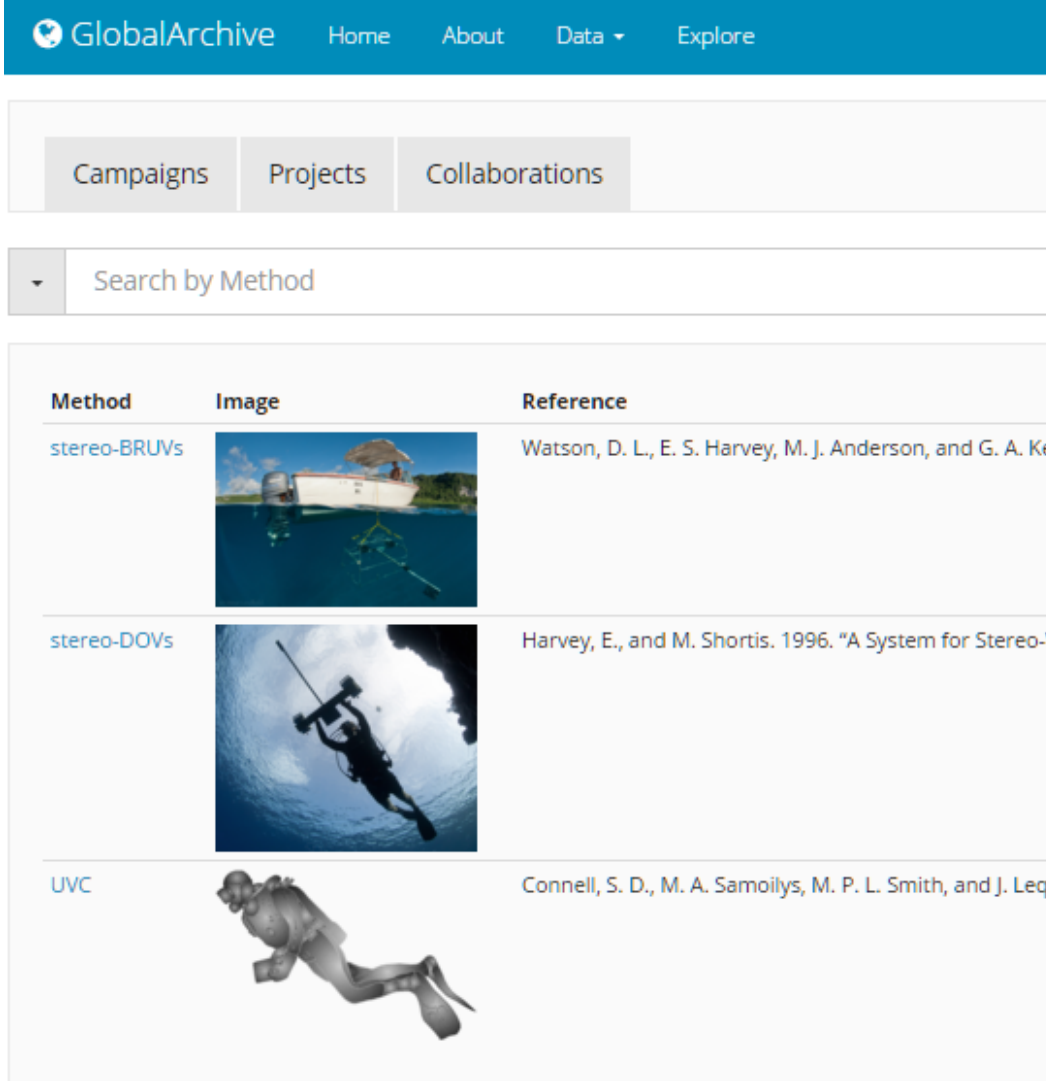


Developed & maintained by Tim Langlois (UWA) and Ariell Friedman (Greybits Engineering)

Support from UWA Emerging Leaders Fund, Gorgon Barrow Island Net Conservation Benefits Fund and the Nectar Science Cloud

GlobalArchive

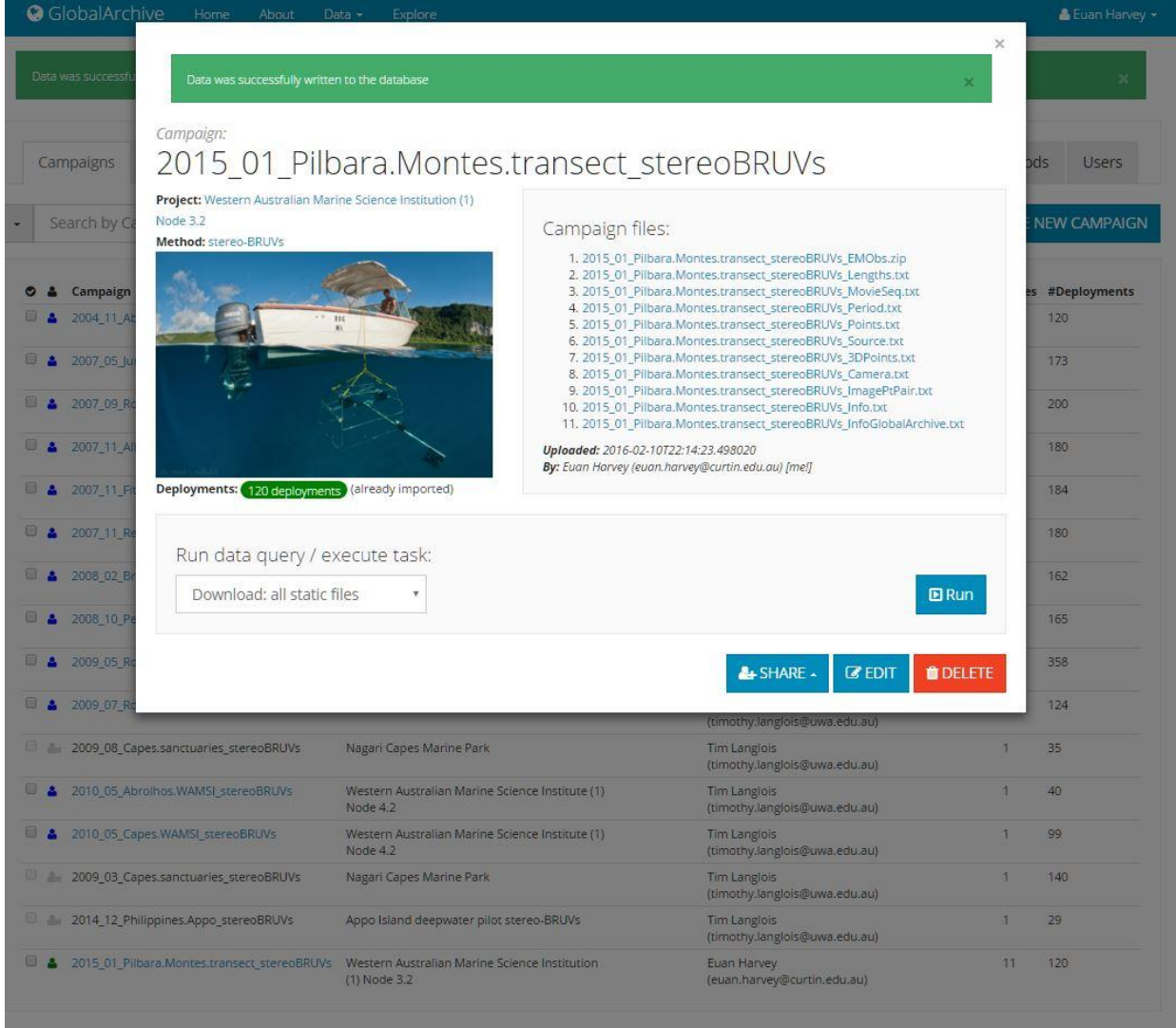
Flexible import of **datasets** from any sampling method



GlobalArchive

Flexible import of **historical** and **modern** annotation data

Direct import from leading stereo annotation software (SeaGIS - EventMeasure)

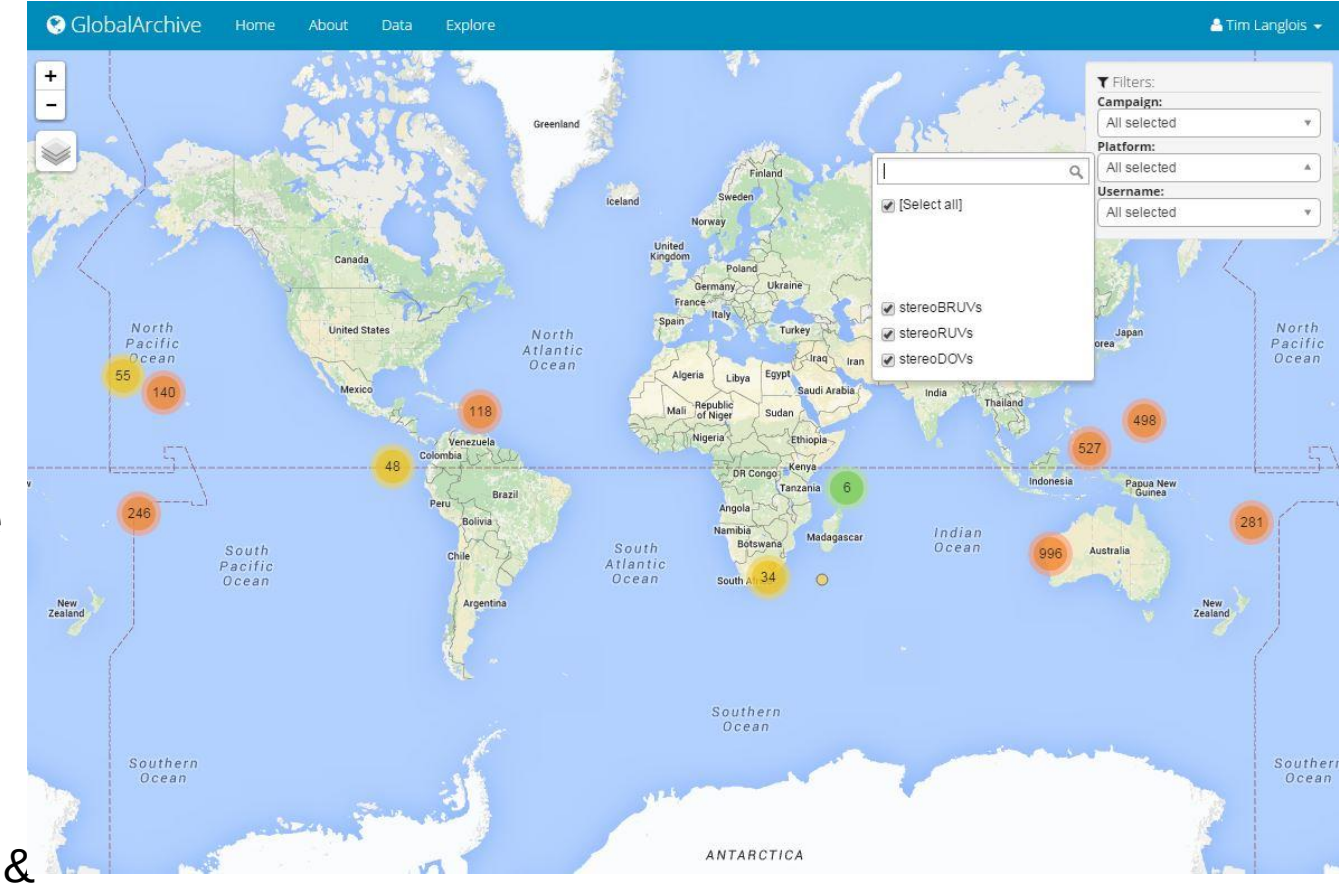


GlobalArchive

Flexible import of **historical** and **modern** annotation data

Direct import from leading stereo annotation software (SeaGIS - EventMeasure)

Working with other annotation initiatives to ensure data transferability & interoperability (GlobalFinPrint)

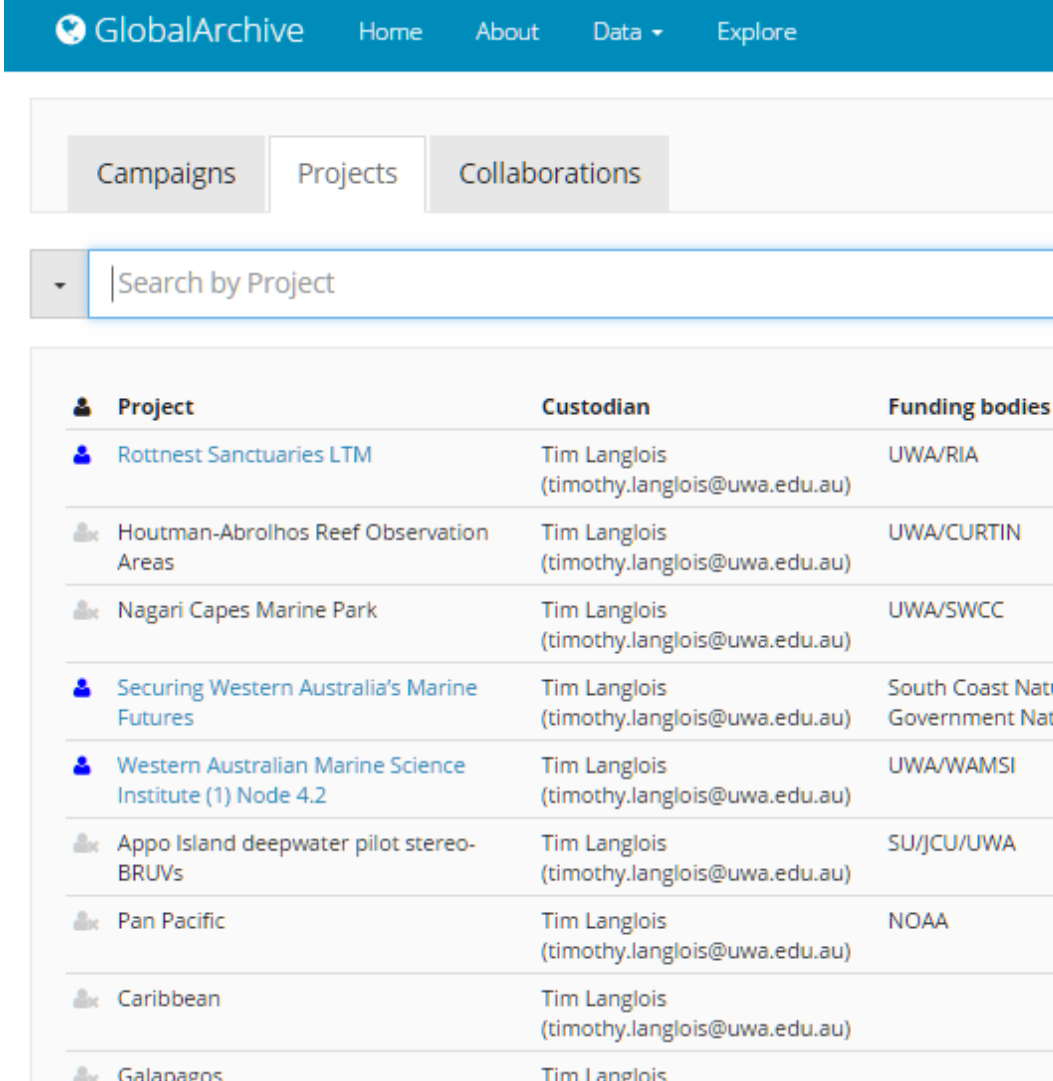


22,000 BRUVs worldwide, https://globalfinprint.org/

GlobalArchive

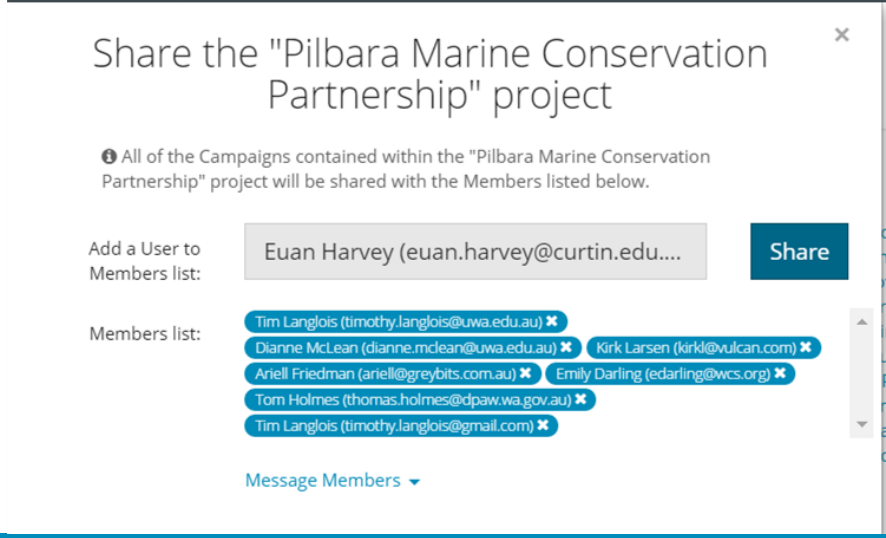
Organisation of multiple Campaigns by Projects

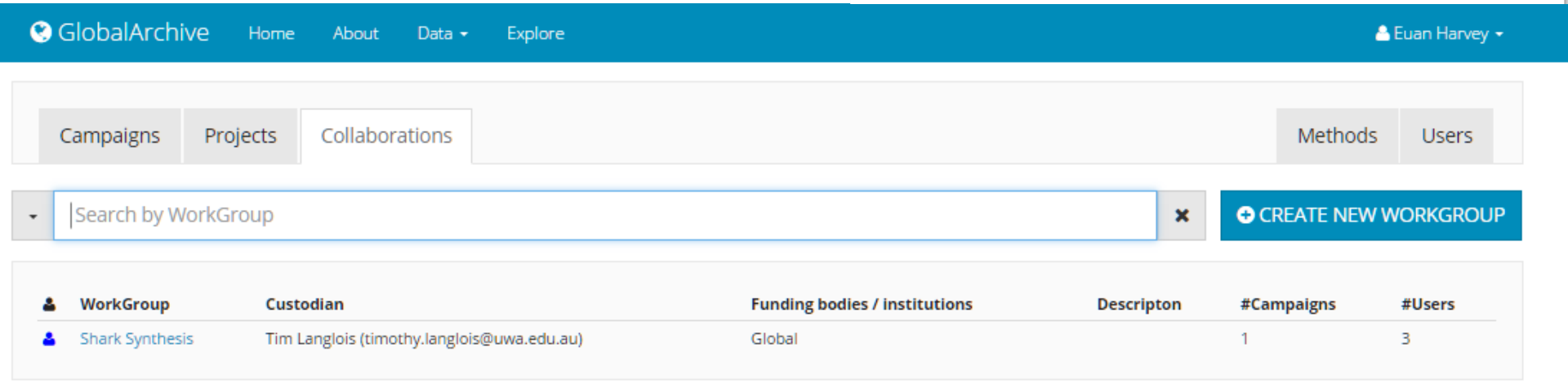
With option to make data sets **Open Access**

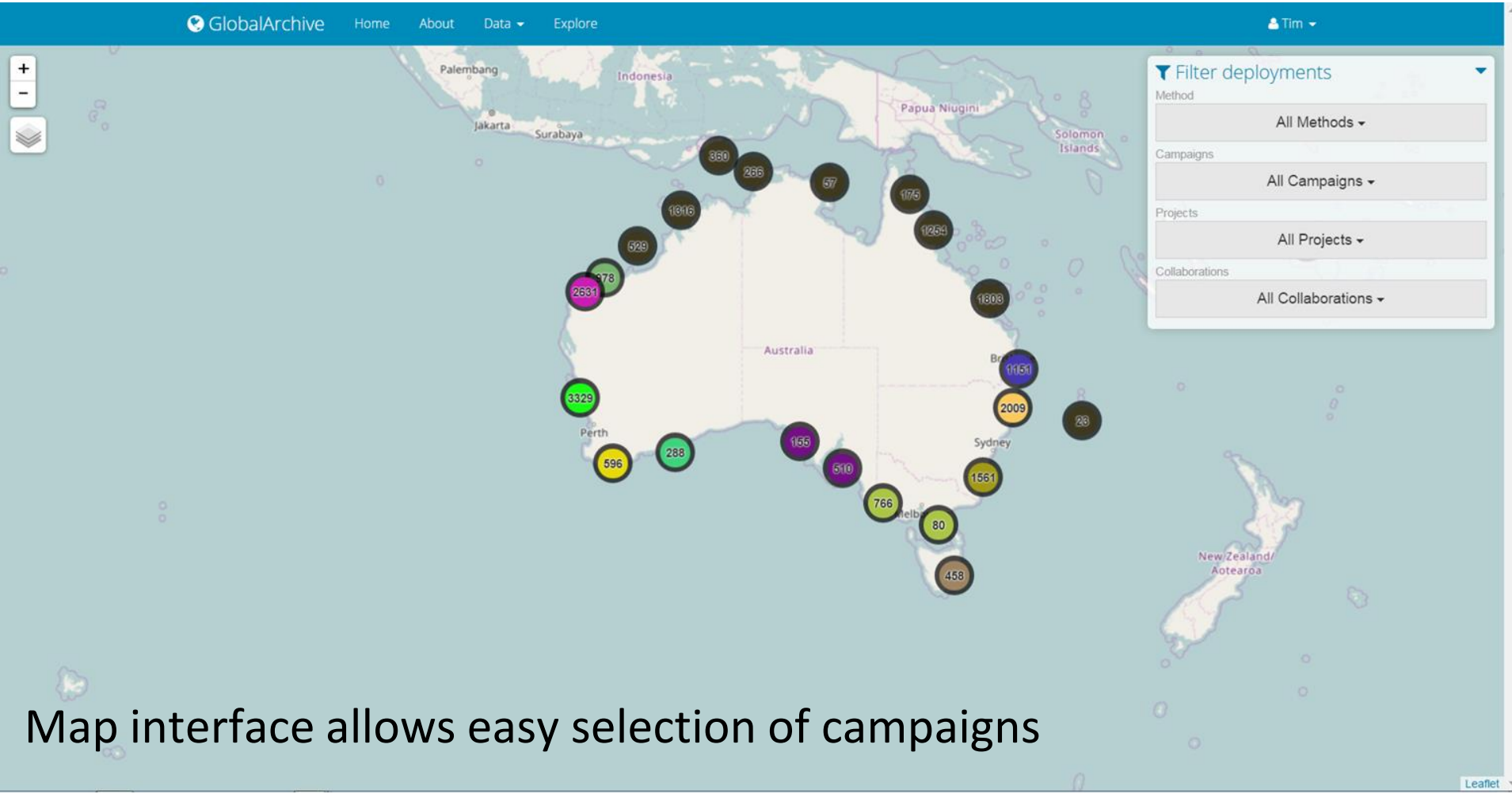


GlobalArchive

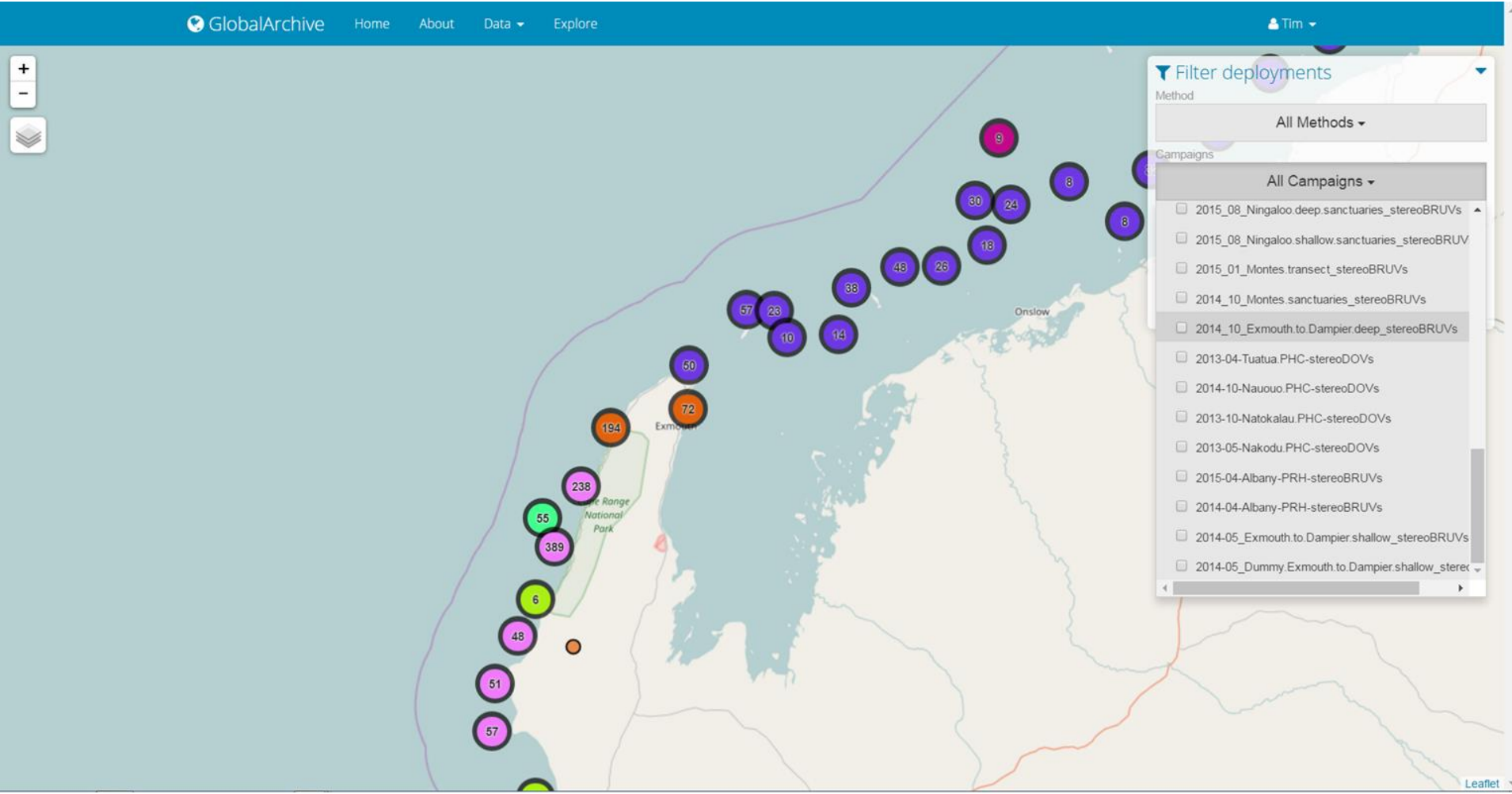
Projects and
Collaborations to share
Campaign data







Map interface allows easy selection of campaigns


GlobalArchive
Home
About
Data
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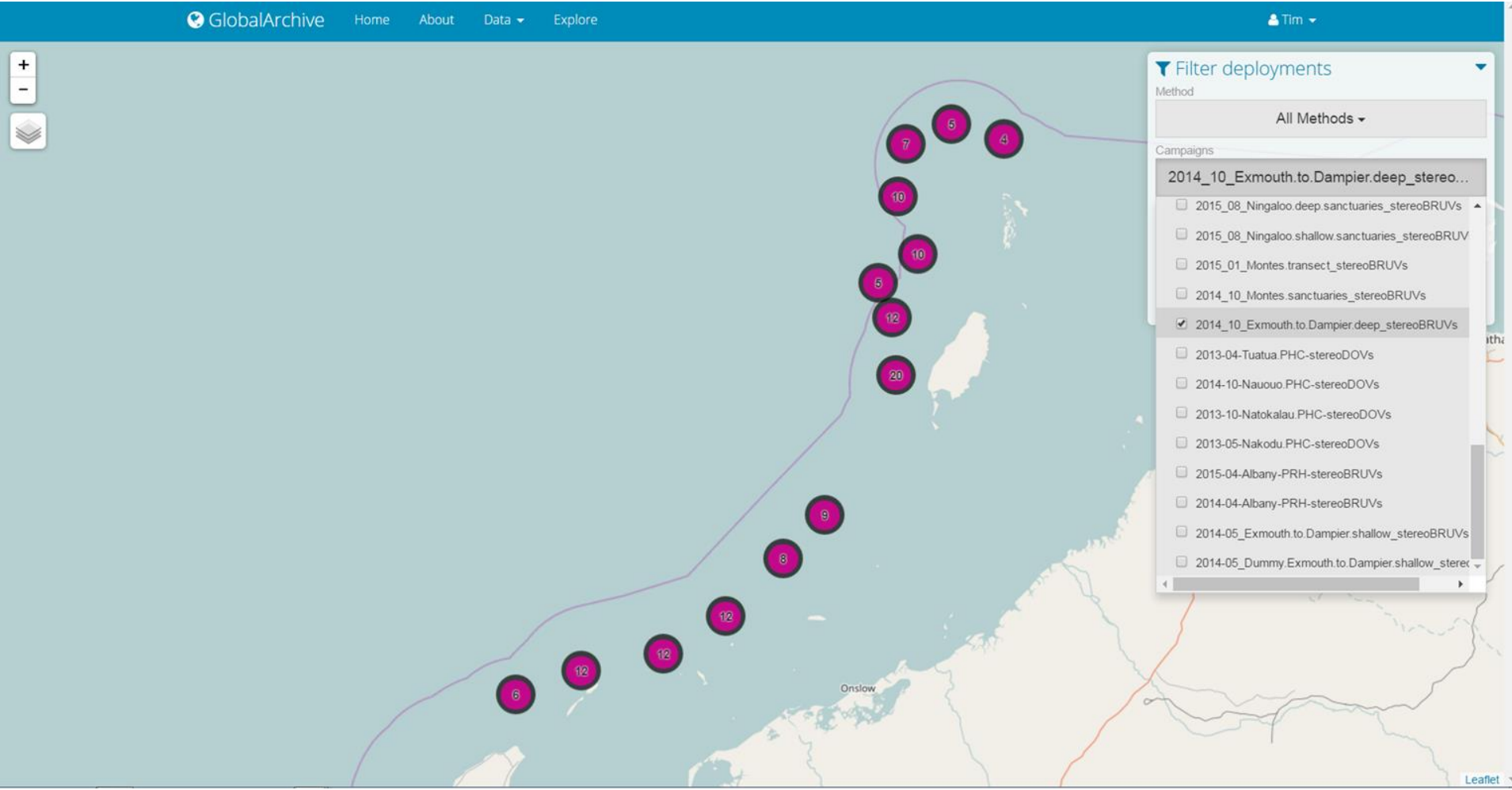
Tim
Filter deployments
Method
All Methods
Campaigns
All Campaigns
2015_08_Ningaloo.deep.sanctuaries_stereoBRUVs
2015_08_Ningaloo.shallow.sanctuaries_stereoBRUV
2015_01_Montes.transect_stereoBRUVs
2014_10_Montes.sanctuaries_stereoBRUVs
2014_10_Exmouth.to.Dampier.deep_stereoBRUVs
2013-04-Tuatua.PHC-stereoDOVs
2014-10-Nauouo.PHC-stereoDOVs
2013-10-Natokalau.PHC-stereoDOVs
2013-05-Nakodu.PHC-stereoDOVs
2015-04-Albany-PRH-stereoBRUVs
2014-04-Albany-PRH-stereoBRUVs
2014-05_Exmouth.to.Dampier.shallow_stereoBRUVs
2014-05_Dummy.Exmouth.to.Dampier.shallow_stereo
Onslow
Exmouth
Range
National
Park
9
8
30
24
8
18
48
26
38
57
23
10
14
60
72
194
238
55
389
6
48
51
57
Leaflet


GlobalArchive
Home
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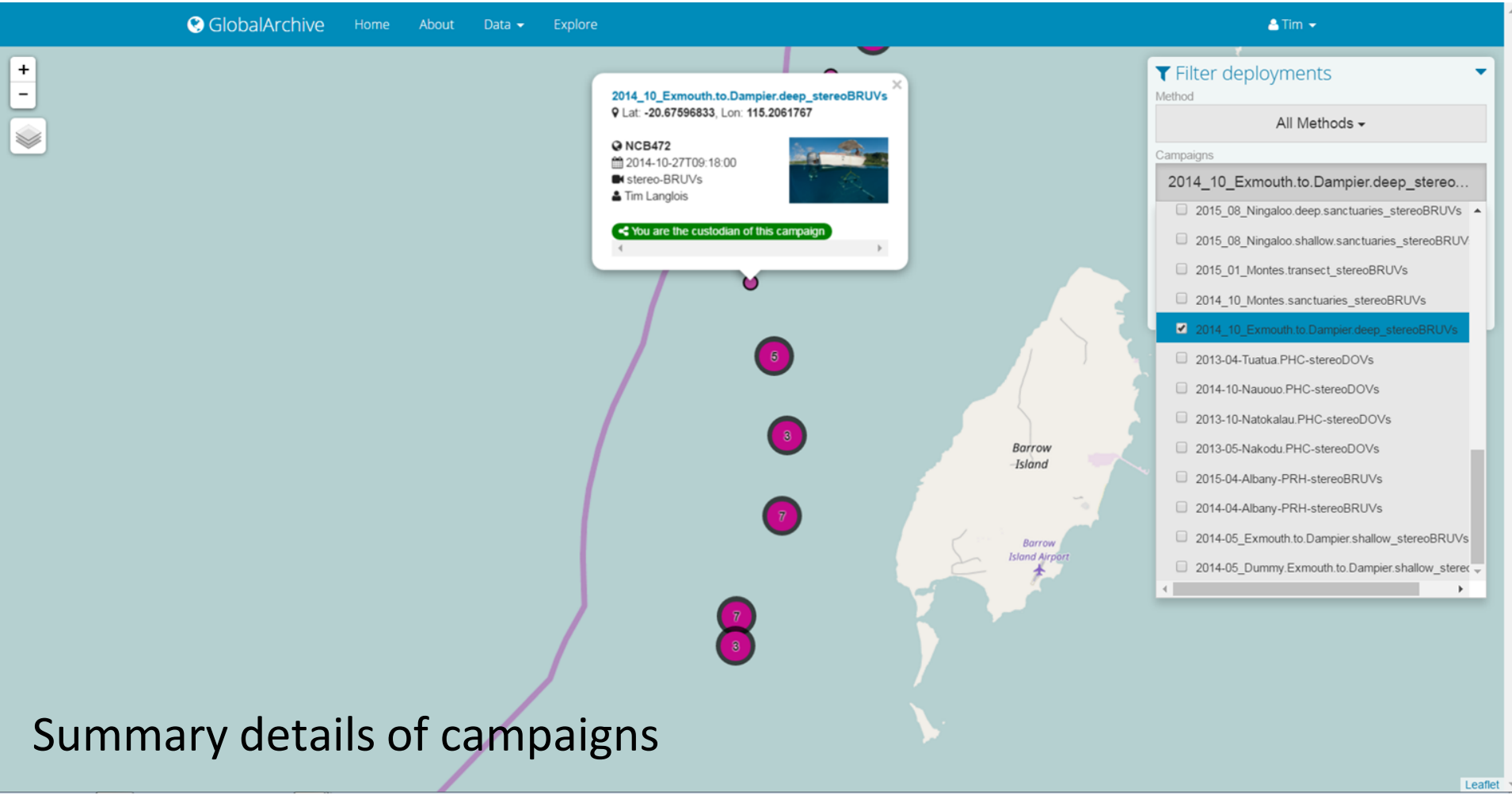
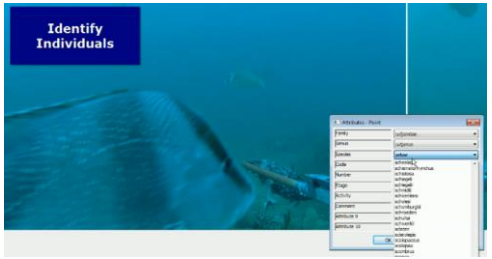
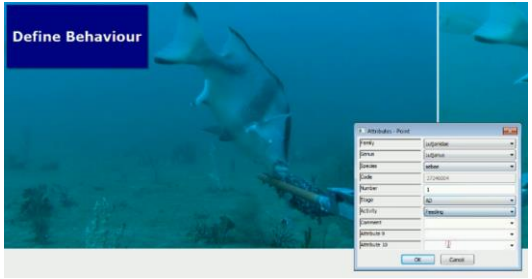
Filter deployments
Method
All Methods
Campaigns
2014_10_Exmouth.to.Dampier.deep_stereo...
2015_08_Ningaloo.deep.sanctuaries_stereoBRUVs
2015_08_Ningaloo.shallow.sanctuaries_stereoBRUV
2015_01_Montes.transect_stereoBRUVs
2014_10_Montes.sanctuaries_stereoBRUVs
2014_10_Exmouth.to.Dampier.deep_stereoBRUVs
2013-04-Tuatua.PHC-stereoDOVs
2014-10-Nauouo.PHC-stereoDOVs
2013-10-Natokalau.PHC-stereoDOVs
2013-05-Nakodu.PHC-stereoDOVs
2015-04-Albany-PRH-stereoBRUVs
2014-04-Albany-PRH-stereoBRUVs
2014-05_Exmouth.to.Dampier.shallow_stereoBRUVs
2014-05_Dummy.Exmouth.to.Dampier.shallow_stereo
Onslow
Leaflet

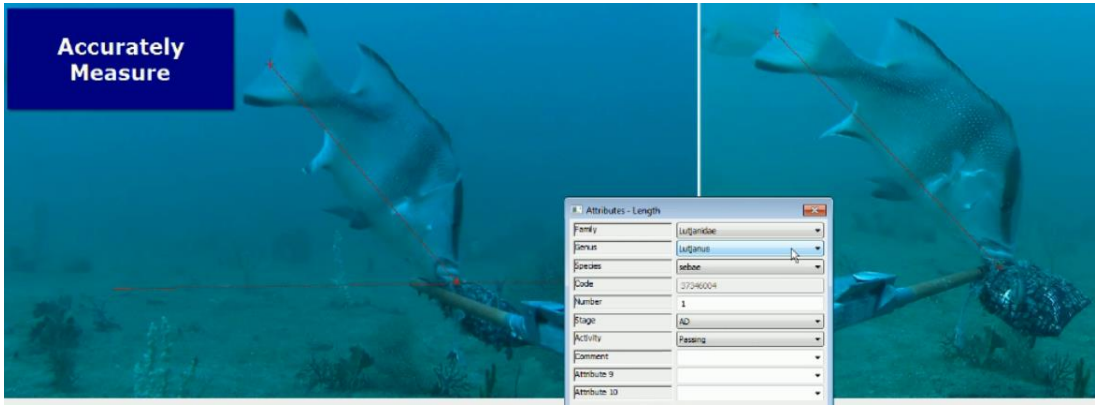


Summary details of campaigns

BRUV analysis…
What does EventMeasure enable you to do?







GlobalArchive Home About Data Explore Tim

Campaigns Users

2014

E NEW CAMPAIGN

Campaign

#Deployments

2014_12_P 29

2014_10_M 80

2014_10_E 132

2014-10-N 18

2014-04-A 35

2014-05_E 267

2014-05_D 0 / Not imported

Conceived by Timothy Langlois at UWA

About Contact

Campaign:

2014_10_Exmouth.to.Dampier.deep_stereoBRUVs

Project: Pilbara Marine Conservation Partnership

Method: stereo-BRUVs

Deployments: 132 deployments (already imported)

Campaign files:

1. 2014_10_Exmouth.to.Dampier.deep_stereoBRUVs_InfoGlobalArchive.txt
2. 2014_10_Exmouth.to.Dampier.deep_stereoBRUVs_Lengths.txt
3. 2014_10_Exmouth.to.Dampier.deep_stereoBRUVs_MovieSeq.txt
4. 2014_10_Exmouth.to.Dampier.deep_stereoBRUVs_Period.txt
5. 2014_10_Exmouth.to.Dampier.deep_stereoBRUVs_Points.txt
6. 2014_10_Exmouth.to.Dampier.deep_stereoBRUVs_Source.txt
7. 2014_10_Exmouth.to.Dampier.deep_stereoBRUVs_3DPoints.txt
8. 2014_10_Exmouth.to.Dampier.deep_stereoBRUVs_Camera.txt
9. 2014_10_Exmouth.to.Dampier.deep_stereoBRUVs_ImagePtPair.txt
10. 2014_10_Exmouth.to.Dampier.deep_stereoBRUVs_Info.txt

Uploaded: *2016-04-04T05:38:41.092104*

By: *Tim Langlois (timothy.langlois@uwa.edu.au) [me!]*

Run data query / execute task:

Download: generated MaxN f

Aggregates: sum(N), max(N) in *_Points.txt file, then merges with *_Metadata.txt

Run

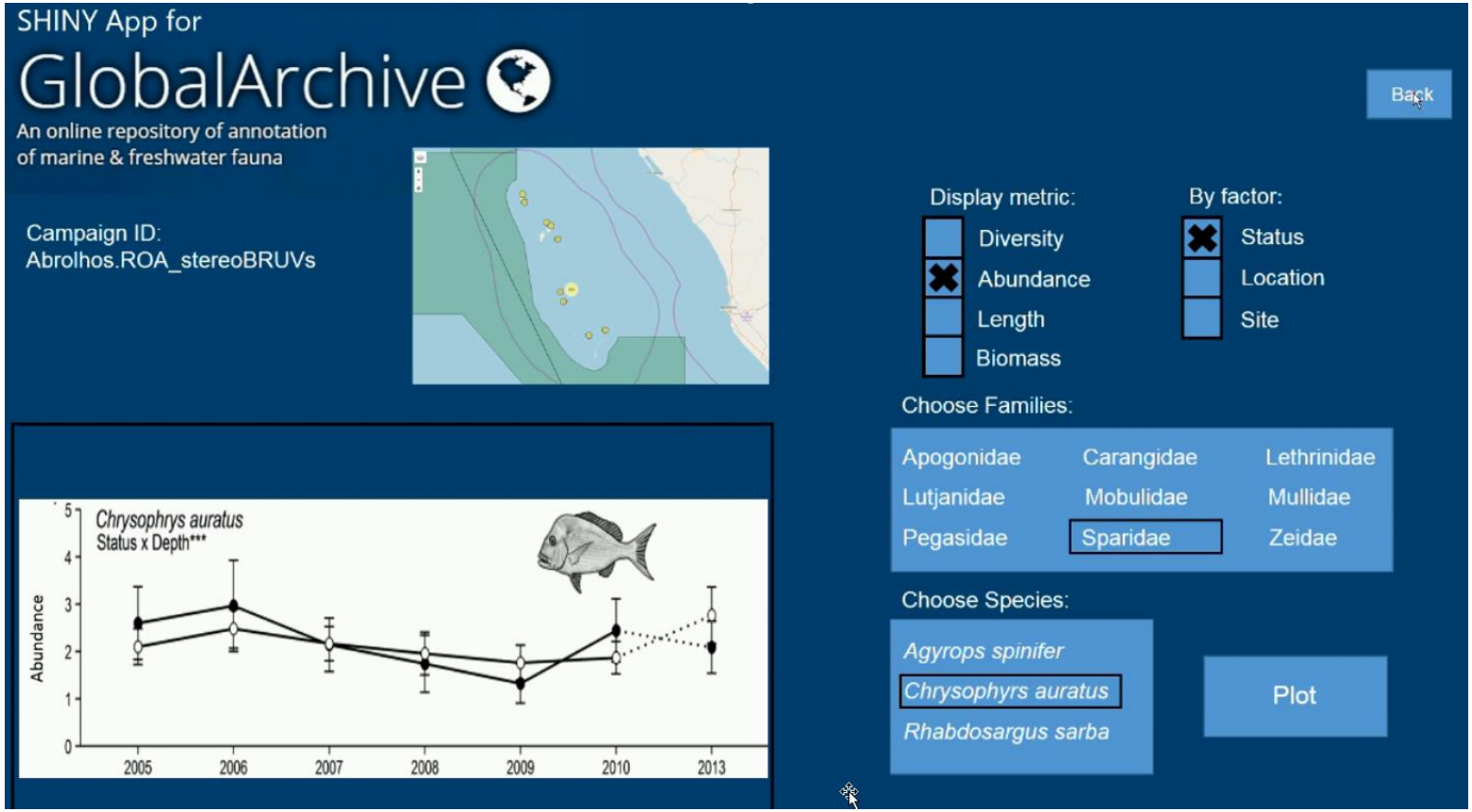
maxN

*_Points.txt

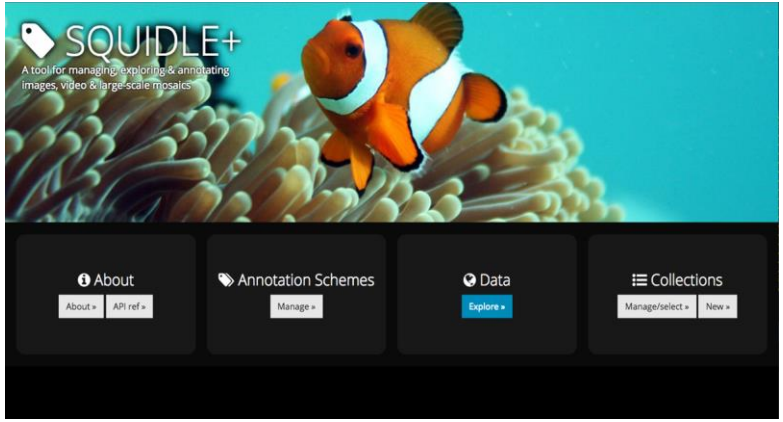
"validate",
'_Metadata.txt",
ignID": {
quired": true,
pe": "string",
nullable": false
},
"Sample": {

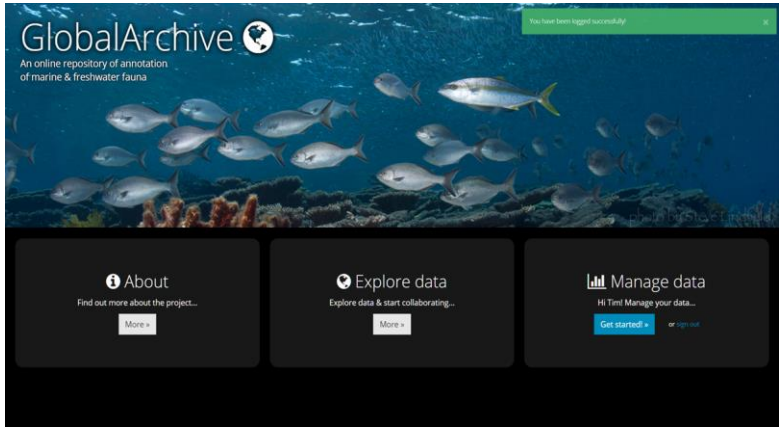
Easy import of a BRUV campaign
Showing EventMeasure outputs

Example ‘plug-in’ tool for analysis of annotations

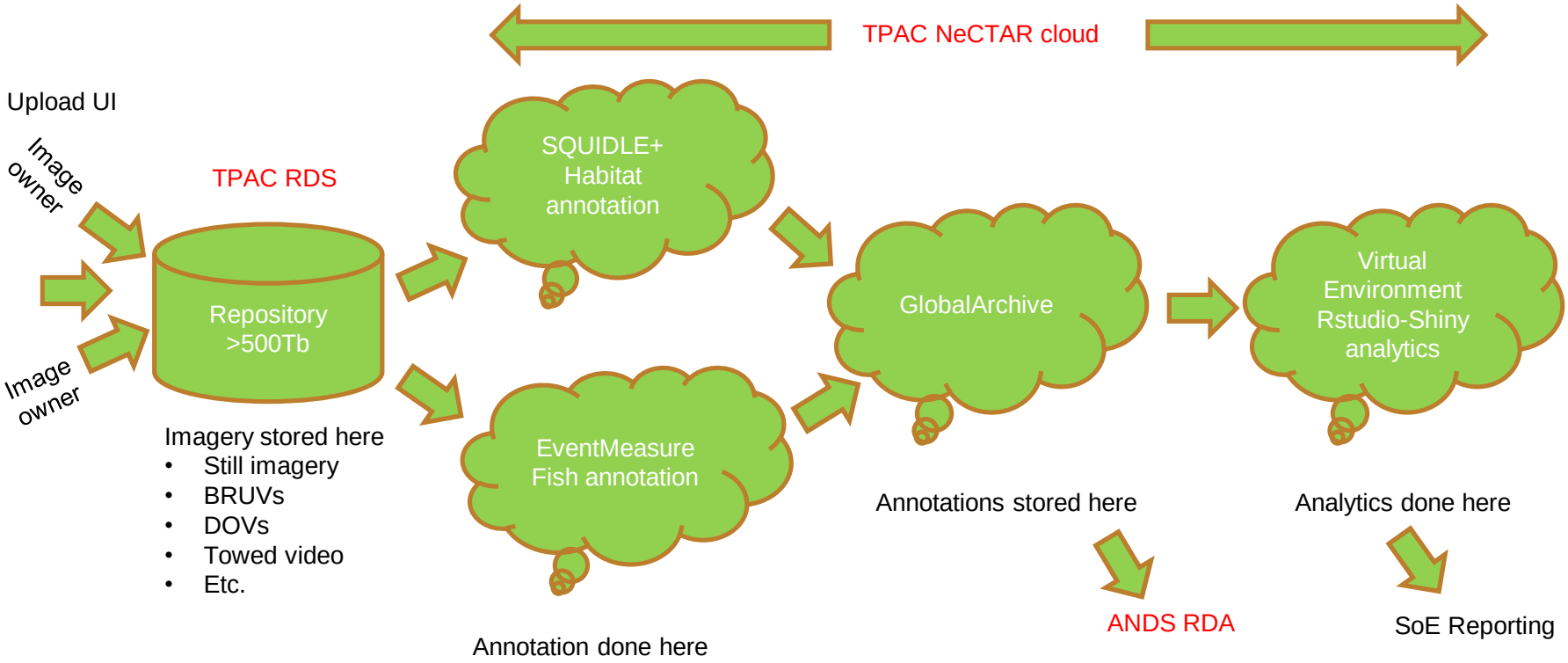


What next?


SQUIDLE+
A tool for managing, exploring & annotating images, video & large-scale mosaics
About
About »
API ref »
Annotation Schemes
Manage »
Data
Explore »
Collections
Manage/select »
New »


GlobalArchive
An online repository of annotation of marine & freshwater fauna
About
Find out more about the project...
More »
Explore data
Explore data & start collaborating...
More »
Manage data
Hi Tim! Manage your data...
Get started! »
or sign out

The National Service for Underwater Imagery



Marine Research Data Cloud (ANDS-NeCTAR-RDS)

The National Service for Underwater Imagery

ANDS – NeCTAR - RDS

IMOS Integrated Marine Observing System

TPAC Tasmanian Partnership for Advanced Computing | UTAS

The University of Western Australia

GREY BITS ENGINEERING

Australian Government
Geoscience Australia