This is a supplementary document from the following research

Application of an open-source geospatial framework for beach litter monitoring and analysis

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Marine Pollution Bulletin

Open-GIS framework tutorial for beach litter monitoring

This material was developed with the objective to help managers to implement a GIS-fieldwork in the beach litter monitoring process. It is based on the default GIS litter project (supplementary material 03) with a brief explanation about the attributes specification followed by directions on how to use the default framework on field or adapt it to specific needs.

All steps described here were performed using QGIS 3.6 and QField v1.0.0 rc-5.

1 Attribute Specifications:

In order to record all desirable information about beach litter and reduce the typos during the monitoring which will prevent long hours of data preprocessing , a cautious field plan is desirable to define the correct field types to be imported in QField project.
The above lines explain the meaning of each attribute in the default litter layer (a point *shapefile* in WGS 84) and specify their Field Type (Right click in the layer > Layer Properties > Source Field) as the Widget Type (Layer Properties > Attribute Form):

i. oceancons: a categorical field with Ocean Conservancy litter item list

Field type: String (Figure. 1)
Widget type: "Value Map" (Figure 2)

It is possible to use another litter classification list, in this case, upload a .csv file with the litter ID

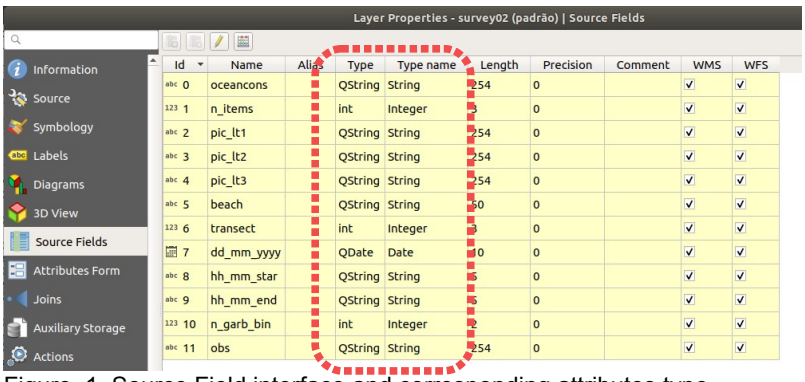

Figure. 1. Source Field interface and corresponding attributes type.

and the corresponding litter name,otherwise, it is also possible to inform directly in widget window.

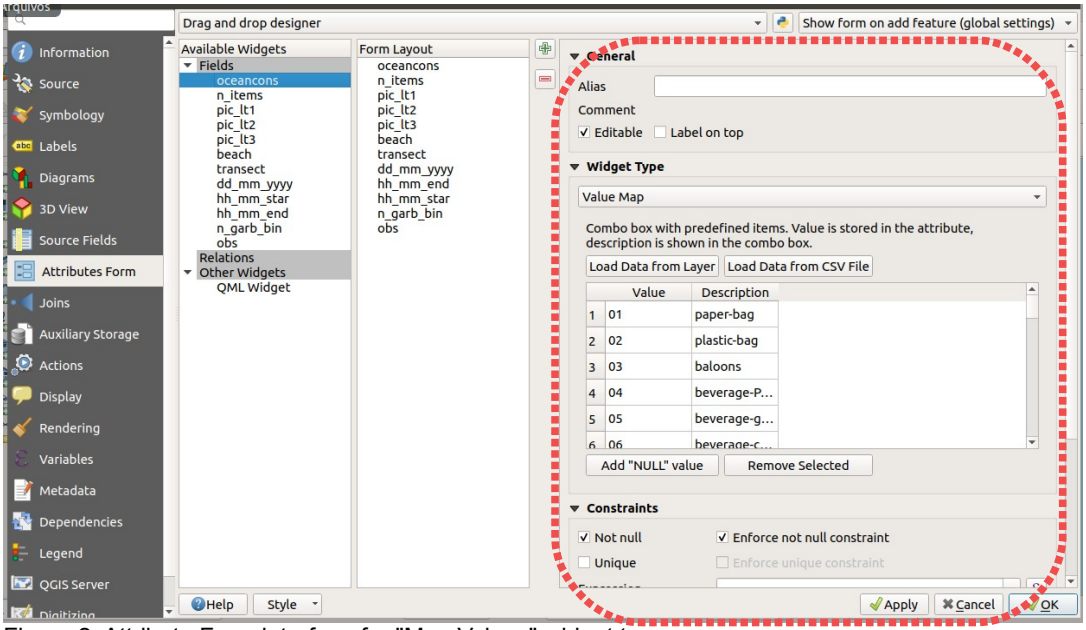

Figure 2: Attribute Form interface for "Map Values" widget type

ii. *n_items: a numeric field to inform the number of items encountered in each point*

Field type: Integer
Widget type: Text edit

iii. *pic_lt1: a picture field of the litter recorded*

Field type: String
To make the widget work properly and save the field work images its is also important to define the field **length to 255** in this case.
Widget type: Attachment (Figure 3)

Additionally, some widget properties were defined with the objective to correctly save the field image and also to access them by clicking in the collected points when the results are imported back to the original QGIS-platform:

Path: Relative to the project path; - Define the Default Path in accordance to the path where your results will be unpackaged
Storage mode: File path; Display button to open file dialog – Check; Integrated Document Viewer - Type: Image

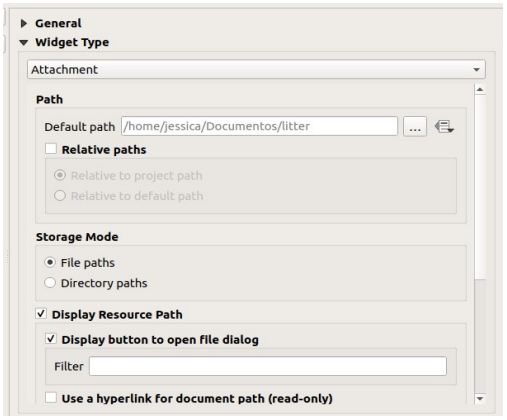

Figure 3: Attribute Form interface for "Attachment" widget type

iv. *pic_lt2: additional picture field, same specifications of pic_lt1;*

v. *pic_lt3: additional picture field, same specifications of pic_lt1;*

vi. *beach: categorical field containing all monitored beaches;*

Field type: String
Widget type: Map Values

vii. *transect: categorical field containing all monitored transects;*

Field type: String
Widget type: Map Values

viii. *dd_mm_yyyy: monitoring date field defined by a pop-up calendar;*

Field type: Date
Widget type: Date/Time (Figure 4)
Field Format: Date

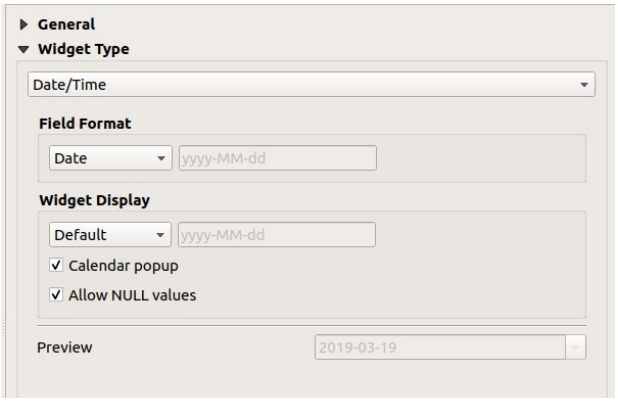

Figure 4: Figure 3: Attribute Form interface for "Date/Time" widget type

ix. *hh_mm_start: monitoring start time (pattern 24H, HH:mm. Ex.: 14:23)*

Field type: String
Widget type: Date/time
Field Format: Time

x. *hh_mm_end: monitoring end time (pattern 24H, HH:mm. Ex.: 14:23)*

Field type: String
Widget type: Date/time
Field Format: Time

xi. *n_garb_bin: number of garbages within the transect monitored*

Field type: Integer
Widget type: Text edit

xii. *Obs: any extra observation that should be considered*

Field type: String
Widget type: Text edit

2 *Monitoring beach litter*

The steps in 2.1 must followed when building new litter projects with specific needs, otherwise, go straight to section 2.2

2.1 Preparing the Data (QGIS):

i. Create your own litter project with the desirable attribute in layers and configure it for beach field work (similar to the attribute configuration presented in section1);

ii. Use the QFieldSync Plugin to package the project for Qfield (Figure 5)

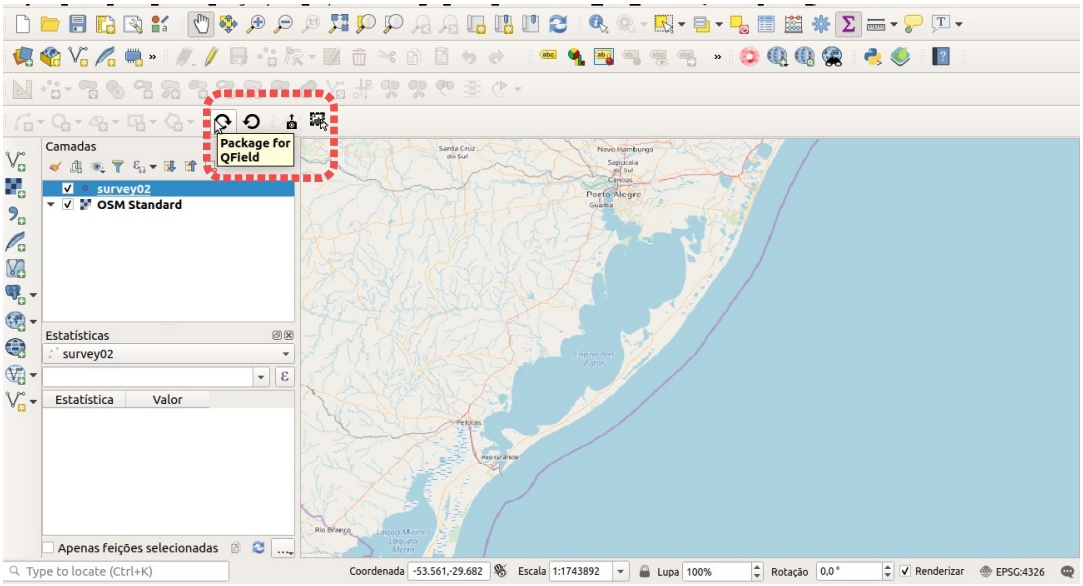

Figure 5: Packaging QGIS project and corresponding layers for QField App

iii. Inside the paste created by the last step ***add a new paste*** and name it "DCIM".

2.2 Import to the GIS-collector (QField):

iv. Download QField App: https://play.google.com/store/apps/details?id=ch.opengis.qfield;

v. Open the app, close it and restart your mobile;

vi. Turn on the mobile and connect it to the PC in the mode "transfer files" and copy the project (the supplementary data 02 of this research or the one created in the previous step) into the following directory:

vii. "Android\data\ch.opengis.qfield\files\share".

viii. Unmount the mobile

2.3 *In the Field:*

ix. Open the project in QField:

Settings (a white tool symbol in the right upper corner) > "*Open Project*"

and select the directory where you copy the paste with your QGIS project (Figure 6);

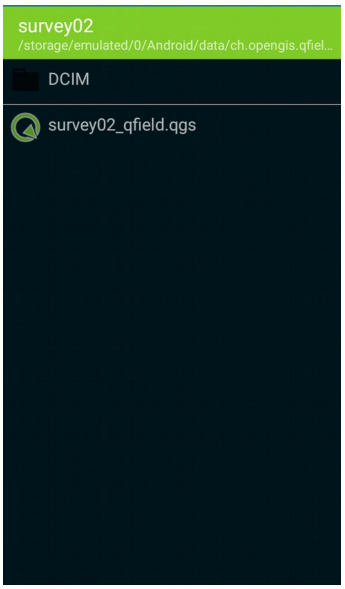

Figure 6: Setting the directory path containing the litter project and associated layers.

x. Select the layer where you will record the litter information and choose the Digitalizing option (pen symbol) (Figure 7).

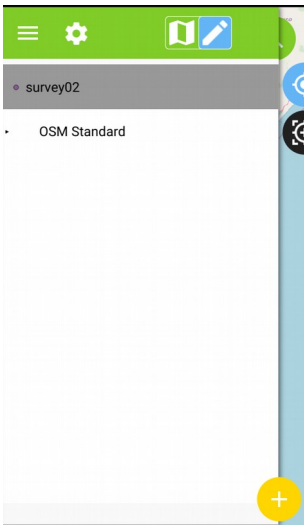

Figure 7: Choosing the "Digitalize" mode to populate the litter layer in field.

xi. Activate the GPS position (**1**), center to the current location (**2**) minimize the layer panel (**3**) add a point corresponding to your current location(**4**). Figure 8 exemplifies this interface.

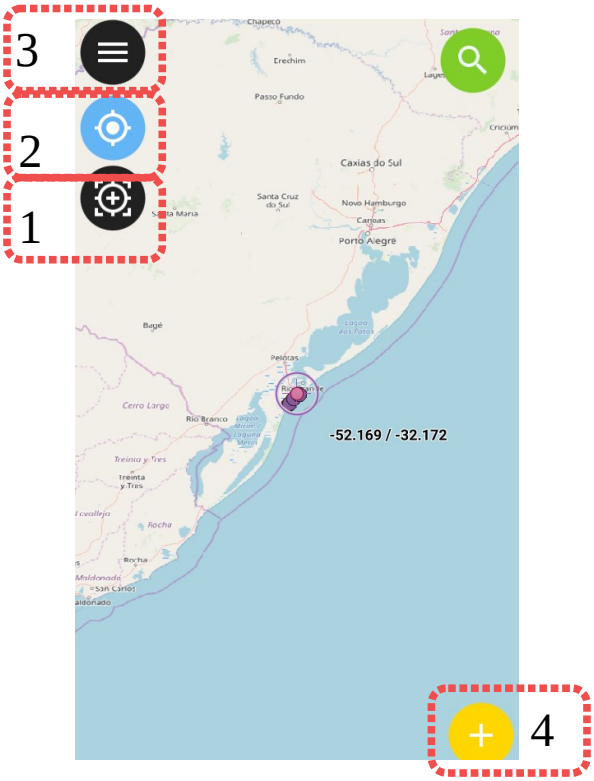

Figure 8: Steps that should be followed to add a point in the current location.

xii. Following, the feature attribute table will be ready to be populated. In the default project, the litter type can be defined in the first attribute in accordance to the Ocean Conservancy list.

IMPORTANT: Attributes that will be repetitively recorded along the survey (as date, beach and transect) can be automatically filled in the next litter record by checking the lateral box as shown in Figure 9.

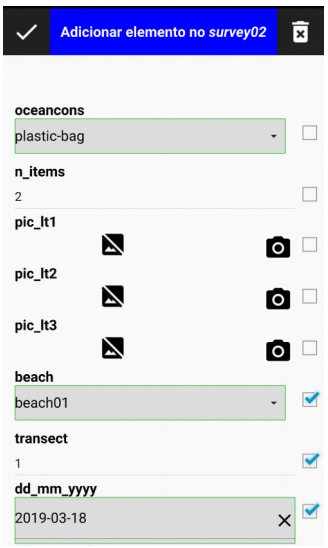

Figure 9: Populated attribute table.

xiii. Take pictures as possible as you can. They will be linked to your litter points.