Department for Environment Food & Rural Affairs

Foreign & Commonwealth Office

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Overseas Territories Environment and Climate Fund

Final Report

Important note *To be completed with reference to the Reporting Guidance Notes for Project Leaders: it is expected that this report will be a maximum of 20 pages in length, excluding annexes*

Project Information

Project reference	ECM_52843 (Defra code)
Project title	Building Data Gateway for Caribbean OT of Montserrat
Territory(ies)	Montserrat
Contract holder Institution	Department for Environment, Food and Rural Affairs
Partner institutions	Joint Nature Conservation Council
Grant value	£154,000
Start/end date of project	September 2018 – March 2019
Project leader name	Amanda Gregory, JNCC
Project website/Twitter/blog etc.	N/A
Report author(s) and date	Amanda Gregory, JNCC: May 2019

Data Gateway for Montserrat

In 2018 JNCC initiated the Building a Data Gateway for Montserrat project. The project was designed to increase data management capacity within the Government of Montserrat (GoM) Ministry of Agriculture, Trade, Land, Housing and Environment (MATLHE) GIS Unit and ensure environmental spatial data becomes accessible, managed and secured in an appropriate manner. The Data Gateway builds upon the existing Metadata Catalogue, to create a web-based mapping system for the display of spatial data, hosted on Government of Montserrat IT infrastructure, and develop a website and interface in the existing GIS unit (WebGIS). The building of the data gateway was supported by a tailored training programme in the use and application of the Data Gateway and wider GIS analytical training.

Through the purchase of a high-capacity servers, creation of linked metadata catalogue to data portal and web-based mapping system MATLHE can now:

- access all data across its departments;
- visualise data, displayed and downloadable with a link to 'who to contact' easy access for decision makers and planners to integrate relevant data into decision making;
- data to include terrestrial, marine, spatial planning and governance data; and
- enable appropriate data to be accessible to the public.

The following was also initiated:

- An integrated fisheries database and application (application on tablet) to enable the efficient and easy collection, collation, analysis and reporting of Montserrat's biological and landings data
- An off-island data repository (cloud) to function as a back-up data system to ensure data security

in the event of hurricane or volcano damage to building and IT equipment; and
- Digitise key paper-based datasets to archive data currently in paper format within the digital system.

These elements will be integrated into the data management gateway managed between the GIS Unit and Department of Information Technology and e-Government (DITES).

1 Project Overview

Montserrat

The 'Emerald Isle of the Caribbean', Montserrat is one of the most highly biodiverse UK Overseas Territories. Covered in dense rainforest the volcanic & mountainous island of 103km^2, is located between the islands of Nevis and Guadeloupe, 43 km south-west from Antigua (Bettencourt & Imminga-Berends, 2015). The beaches are both white and black fed by the fringing coral reefs mixed with volcanic sands. The Soufriere Hills volcano became active in 1995 causing the evacuation of the Montserrat's capital Plymouth and most of the south part of the island. The volcano caused extensive damage to biodiversity and the associated ecosystems; coral reefs, wetlands and protected areas as well as to agricultural production and fisheries. More than half the island lies within the exclusion zone, Figure 1.

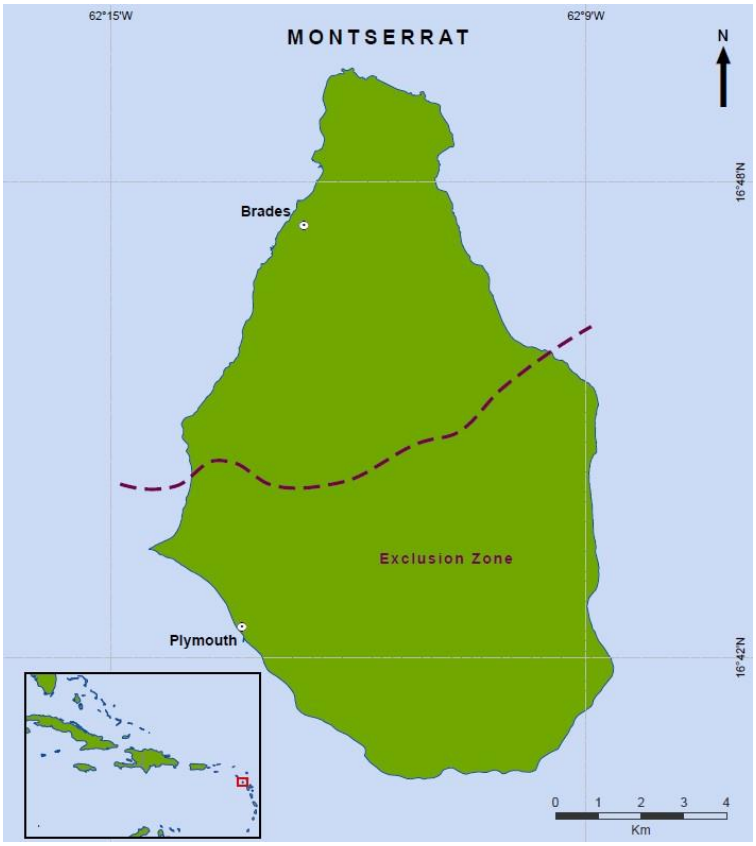


Figure 1. Montserrat

The Soufriere volcano has been active since 1995 causing extensive damage to biodiversity and ecosystems and has caused social and economic disruption, with the migration of 2/3 of the population (OCTA, 2015). Infrastructure was destroyed, the thriving tourism industry was severely reduced and agriculture sector was devastated. Hurricanes also pose a serious risk and are expected to become more frequent and intense in the future because of climate change. Montserratians are working to overcome the crisis and move on to redevelop infrastructure, economy, and industry that supports and encourages a growing and more independent population.

Background to data management project

Data handling and management is a significant limiting factor in most of the UK's Overseas Territories. The ability to generate new data through space, ship and airborne sources is growing rapidly making it difficult even for well-resourced UK organisations to store and manage the data. The Overseas Territories are much less well equipped in terms of physical and human resources to store, manage and make effective use of the data being acquired over their terrestrial and marine environments. Of the Caribbean UK OTs, Montserrat is the least well equipped to cope with these data management issues.

Effective management of data generated by projects supported by the UK Government (Darwin Plus, CSSF and ODA programmes), the EU BEST Programme, NGO funded projects and projects funded by regional development funds (for example the Caribbean Development Bank) is essential to maximise the value of the money invested in these programmes. The integration of data from disparate sources, generated by different bodies on-island or overseas, and with different specific objectives (environmental, infrastructure planning, climate change response etc) is also essential for effective policy implementation and associated planning for the terrestrial and marine environments.

Multiple projects funded through a variety of sources and domestic project work generates extensive quantities of data, often in different formats and different standards some of which are incompatible with the national GIS and data management systems. The quantities of data generated by past projects alone exceed the capacity of the current Government system to store, collate and manage the data. New projects in progress, particularly based on satellite and shipborne surveys, will generate new data at an increasing rate.

With each new project, data theoretically available to the Government of Montserrat increases but in practice the data management capacity remains static resulting in constraints to strategic planning and decision making; the amount of data accumulating continues to outstrip the island's ability to store and collate new material. Coupled with the inability to access data which already exists, and fully benefit from new data, seriously compromises their ability to manage their marine and terrestrial environments and make effective, evidence based, decisions concerning infrastructure development, land use planning and maximising domestic food production from the terrestrial and marine environments.

There is also an historic loss of data from the 1990's volcanic eruption Montserrat. This was primarily paper based and included aerial photography, statistics and scientific papers and associated data. While some data remains, only a small amount has been digitised and therefore remain vulnerable to future events. Data stored exclusively on the island is vulnerable to damage/loss due to natural disasters – hurricane and volcano related, as was borne out during the 2017 extreme hurricane season. The event highlighted elsewhere in the region that on-island duplicate servers do not necessarily offer a totally secure level of data holding.

The original fisheries database was developed by, and enabled reporting to the Caribbean Regional Fisheries Mechanism (CRFM), as well as national, FAO and wider reporting. This database ceased to offer functionality in early 2013 resulting in loss of pre-2013 data. Difficulties in collecting and storing new data lead to questionable fisheries reporting at the national level.

Environmental challenges

This project aims to enhance Montserrat's ability to store, manage, use and undertake analysis data in the face of the increased pressures of climate change, future threats faced by hurricane damage (wind and water), and volcanic activity. The project also aims to develop efficient **fisheries data collection database and systems** to enable national and international reporting and to support Marine Spatial Planning, and a **data management gateway** (comprising data portal and web-based mapping system) to enable integrated spatial planning and management decision-making.

Challenges

In an ever-increasing digital data reliant world data loss has the capacity to significantly impact the day to day running of the whole island and its ability to quickly recover post-event. Every Ministry and Department in the Government of Montserrat are data dependent. In addition to this there is a vast amount of data produced by UK & EU funded projects, international university researchers and NGOs – all of which should be made available to the Government of Montserrat to better improve decision making.

In recent years, JNCC's Overseas Territories work has recognised, through training programmes and consultations in the OTs, that this issue is of increasing concern to the Territories themselves.

Montserrat recognises that the value of projects supported by the UK Government is compromised by their limited ability to access data generated by this work, integrate it into national information management systems and undertake analysis.

As a response, JNCC initiated data management projects in Anguilla and Montserrat using ODA and CSSF funds, these designed to enhance their data management capacity to ensure the maximum legacy from UK Government project investment in the Territories. In Montserrat this included building a metadata catalogue for the Ministry of Agriculture, Trade, Land, Housing and Environment (MATLHE). Prior to Hurricane Irma, in the Summer of 2017, JNCC was discussing with the Government of the British Virgin Islands (BVI) a similar project. The severe damage to Government infrastructure has halted this discussion pending reconstruction.

Addressing the challenges

Having recognised the critical need to provide support to the Government of Montserrat in respect of data collection, storage and management, and the need for training to support this work a joint JNCC and Montserrat Steering group was established. The priority needs for Montserrat were identified with the aim to build on previous projects, delivery sustainable management systems and train a cross section of the Government of Montserrat.

Project aim: to provide Montserrat with a self-sufficient, secure data management system. This will build a **data gateway for Montserrat** to:

- Identify and collate key spatial datasets;
- Enable effective management and use of datasets;
- Facilitate data sharing;
- Enable the collection of data once for use many times;
- Store and retrieve data effectively;
- Protect Montserrat's data from future extreme events;
- Digitise historic datasets;
- Meet sustainable management goals by integrating data;
- Support Montserrat's national reporting to regional and international agreements;
- Help stakeholders understand the value of Montserrat's natural environment;
- Support reconstruction of built infrastructure and agricultural capacity 'post volcano'.

The project will:

- Support integrated fisheries data collection and storage;
- Develop long term cloud-based data solutions;
- Support training and capacity building in data management and analysis; and
- Facilitate digitisation of priority historic data sets.

The project brought together and built upon existing project work but also utilised JNCC experience from building a Data Portal for Anguilla[1] and of developing small island information management systems gained in the South Atlantic[2].

2 Project Stakeholders/Partners

The project was developed fully under the direction of Permanent Secretary, Mrs Silcott-Greaves, Ministry of Agriculture, Trade, Land, Housing & Environment (MATLHE) and with the support of Director Ms O'Garro, Agriculture and MATLHE technical staff from Fisheries and GIS. The Department of Information, Technology and eGovernment Services (DITES), Director Mr West provided expert services supporting data server incorporation into the national system, with technical assistance from Mr Williams to help storage and manage the IT systems providing support throughout the project.

[1] The Anguilla Data Portal (https://anguilla-portal.envsys.co.uk/) Originally intended for the sole use of the Department of Environment now supports the use of spatial data sets across the entire Government of Anguilla.
[2] In the South Atlantic JNCC supported, through FCO funding, the development of a Falkland Islands based Information Management System to support data management by all South Atlantic OTs (http://www.south-atlantic-research.org/ims-gis).

The Project Management Board is outlined in Figure 2.

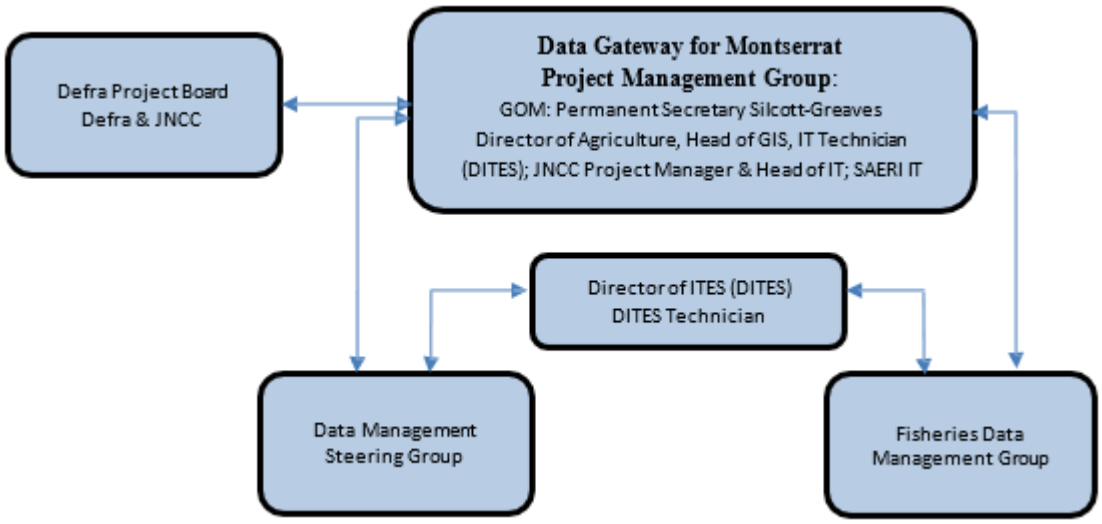


Figure 2. Data Gateway for Montserrat Project Management Board

The data gateway and fisheries database builds upon the work of the Government of Montserrat GIS, Fisheries and Physical Planning Units. The engagement and inputs of these Units in the development of the final products, and that of the DITES on how they function within the existing national data management systems, was essential to deliver functional and useable products.

Two technical working groups were formed, both inputting to the project application and project delivery:

1. **Data management steering group**: comprising GoM Head of GIS, GoM Technician from DITES, JNCC Head of IT, SAERI (Contractors) WebGIS Developer, University of Dundee Developer and JNCC Project Manager (Fig 3).

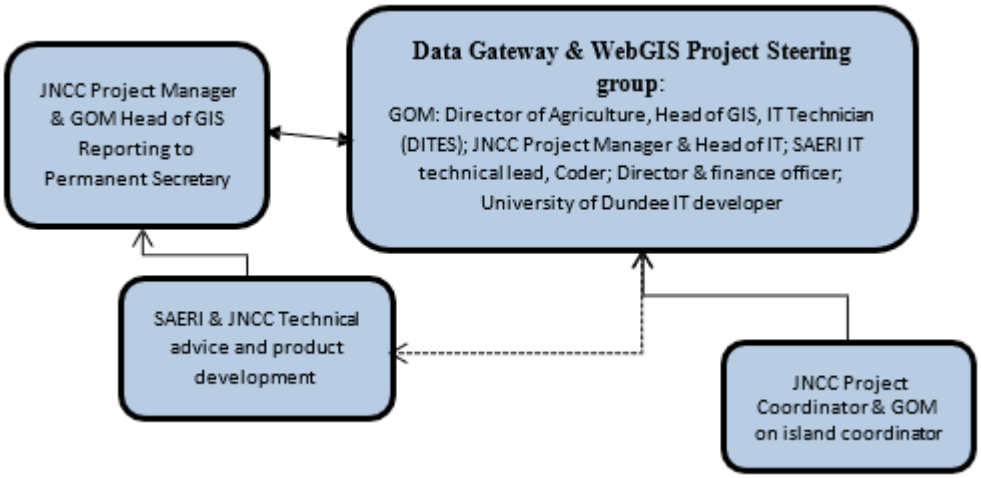


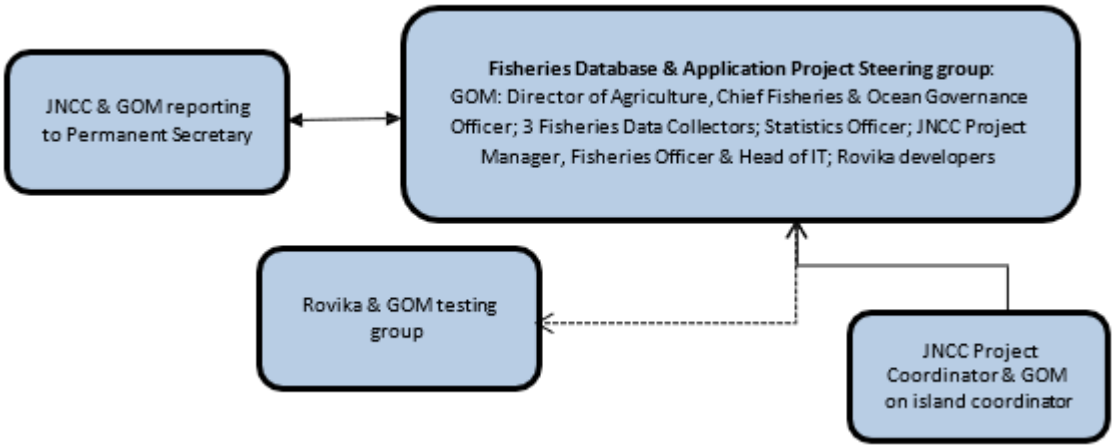
Figure 3. Montserrat Data Management Steering Group

The project initiation meeting was held in Dundee on 14 November 2018 and weekly Skype Data gateway Steering Group meetings held. Two on-island meetings were held at the project outset, between GoM DITES and JNCC Head of IT, and GoM Permanent Secretary, Director of Agriculture and JNCC Montserrat Data Management Project Manager to ensure full collaboration, input, discussion and implementation understanding.

The Steering Group meetings were complemented by more targeted technical developer meetings. These meetings were held between JNCC, SAERI, GOM DITES and GIS Unit. They focussed on specific areas that required trouble-shooting or problem solving seemed to work well for project implementation such as hardware needs, software development and configuration and networking

required to support the installation of the server containing the data repository, webGIS and data portal and fisheries database for GOM.

2. **Fisheries Database and Application Steering Group**: comprising GOM Chief Fisheries and Ocean Governance Officer, Rovika Montserrat developer, GOM Data Collectors and Statistics



Department, JNCC Fisheries Officer, JNCC Head of IT and JNCC Project Manager (Fig 4).

Figure 4. Fisheries Database & Application Project Steering Group

After project initiation fortnightly teleconference meetings were held. As development and testing of the final database, application and reporting needs neared completion, weekly telephone steering group meetings were held. The inclusion of the data needs from the GOM Statistics Department has meant that the data collection is able to satisfy more than one reporting need. This was complemented by on the ground by application and database trials, often daily meetings were held in Montserrat to test and trial the database.

The main challenge was maintaining momentum of work when off-island. With board remit of work and Departments have limited staff members the pull to other projects and for day-to-day work presented challenges. Government staff are expected to deal with such a wide variety of work and international and well as local demands that they focus on who is on-island working in front of them as the priority. However, knowing this the budget reflected the need to sometimes travel at short notice to Montserrat to drive the project forward.

3 Project Achievements

3.1 Outputs

Six (6) outputs have been delivered.

A. An integrated fisheries database and application (app on tablet) to enable the efficient and easy collection, collation, analysis and reporting of Montserrat's biological and landings data and support sustainable fishery practices.

The **fisheries database** has been completed and currently sits on the contractor's cloud system. It is fully functioning and in use by the Fisheries Data Collectors. The plan will be to move to the GOM server once the database has been in use for 3-6 months and any teething problems or glitches have been rectified. The Montserrat based contractor agreed to one-years database support post completion.

The database collates (fig 5) and records information on: vessel registration, port authority log activity, fish activity interviews.

	A	B	C	D	E	F	G	H	I	J	K	L
1	number	started_at	ended_at	interviewe	vessel	departure	return_sit	departed_	returned_	master_of	number_c	fuel
2	Feb-19	2019-03-30	14:05:29	Administr	Daily Brea	Little Bay	Little Bay	2019-03-2	2019-03-3	Test Capta	2	300
3	Mar-19	2019-03-30	15:33:56	Administr	Experienc	Little Bay	Little Bay	2019-03-3	2019-03-3	Reginald B	4	250
4	Apr-19	2019-04-01	21:32:45	Administr	Every Tim	Bunkum B	Bunkum B	2019-05-1	2019-04-0	Anyone	4	300
5	May-19	2019-04-09	14:51:58	Administr	Rainbow F	Little Bay	Little Bay	2019-03-0	2019-03-0	Jeffrey Ry	2	100
6	Jan-19	2019-03-2	2019-04-0	Administr	Ann Elizab	Little Bay	Little Bay	2019-03-2	2019-03-2	Ponteen	2	120
7	Jun-19	2019-04-23	19:10:11	Administr	Try Me	Little Bay	Little Bay	2019-04-2	2019-04-2	John Allen	2	80
8	Jul-19	2019-04-24	13:30:08	Administr	Experienc	Little Bay	Little Bay	2019-04-2	2019-04-2	Fred Blake	3	100
9	Aug-19	2019-04-24	13:58:27	Administr	Every Tim	Little Bay	Little Bay	2019-04-2	2019-04-2	Leon Allen	2	70
10	Sep-19	2019-04-25	13:00:10	Chase Buf	Ann Elizab	Little Bay	Little Bay	2019-04-2	2019-04-2	James We	2	100
11	Oct-19	2019-04-25	13:26:54	Chase Buf	Experienc	Little Bay	Little Bay	2019-04-2	2019-04-2	Reginal Bl	3	100
12	Nov-19	2019-04-25	14:05:28	Chase Buf	Try Me	Little Bay	Little Bay	2019-04-2	2019-04-2	field trip	2	50
13	Dec-19	2019-04-25	14:05:58	Chase Buf	Try Me	Little Bay	Little Bay	2019-04-2	2019-04-2	Field Trip	2	50
14	13/2019	2019-05-02	13:44:20	Chase Buf	Experienc	Little Bay	Little Bay	2019-04-0	2019-04-0	Fred Blake	3	100
15	14/2019	2019-05-02	13:54:16	Chase Buf	Experienc	Little Bay	Little Bay	2019-04-0	2019-04-0	Fred Blake	3	90
16	15/2019	2019-05-02	13:57:46	Chase Buf	Optimum	Little Bay	Little Bay	2019-04-1	2019-04-1	Sheldon C	1	90
17	16/2019	2019-05-02	14:04:45	Chase Buf	Ann Elizab	Little Bay	Little Bay	2019-04-1	2019-04-1	James We	2	90
18	17/2019	2019-05-02	14:15:51	Chase Buf	Every Tim	Little Bay	Little Bay	2019-04-1	2019-04-1	Leon Allen	2	80
19	18/2019	2019-05-02	14:21:55	Chase Buf	Experienc	Little Bay	Little Bay	2019-04-1	2019-04-1	Fred Blake	4	100
20	19/2019	2019-05-02	14:24:20	Chase Buf	Optimum	Little Bay	Little Bay	2019-04-1	2019-04-1	Sheldon C	1	90
21	20/2019	2019-05-02	14:28:56	Chase Buf	Optimum	Little Bay	Little Bay	2019-04-1	2019-04-1	Sheldon C	1	100
22	21/2019	2019-05-02	14:31:50	Chase Buf	Try Me	Little Bay	Little Bay	2019-04-2	2019-04-2	John Allen	2	70

number-of-interviews-2019-01-01

Figure 5. Fisheries database full interview report

The tablets purchased to ensure efficient recording of dock-side fishery data collection sync with the database. This will reduce input error which historically has occurred between data collection and office system input.

The **fisheries data collection application** (Fig 6) is now fully functional and in use by the three GoM Data Collectors (Fig 7).

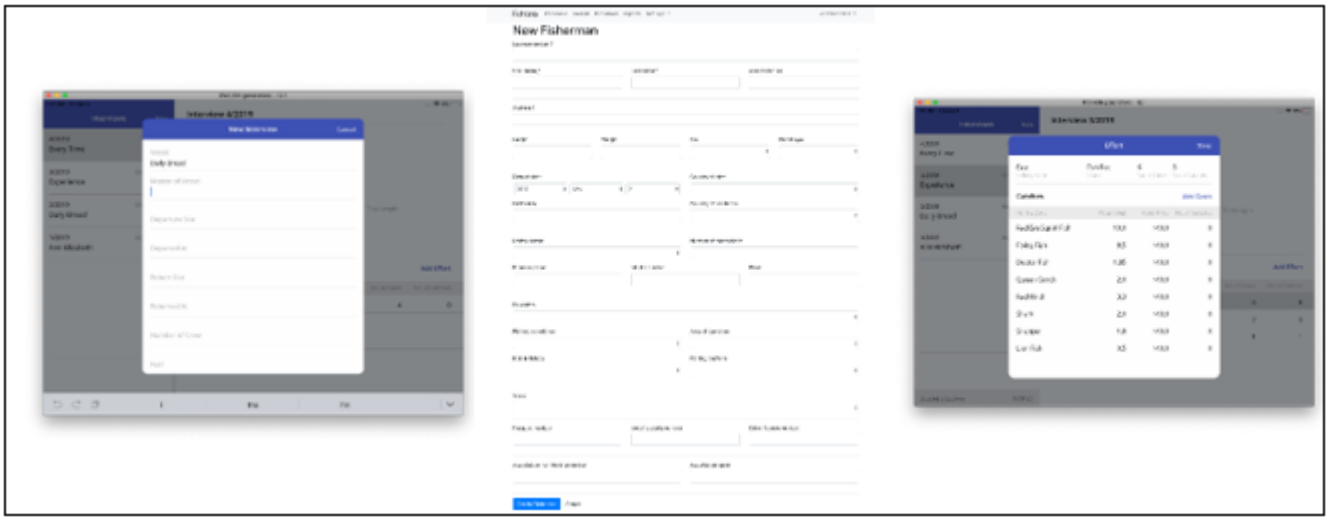


Figure 6 shows screen shots from the fisheries data application

Training (Fig 7) of key GoM personnel was undertaken during all stages of the project. This ongoing training enables full understanding of the development of the products as well as the ability to upload and use data held on data portal and webGIS systems. Further GoM personnel were trained in upload and use of the final system in Montserrat in March 2019 in collaboration and as part of the QGIS training.

Figure 7. Fisheries data application training by Mr Manish Valechha, developer, and in use by Montserrat Data Collectors, Mr Chase Buffonge and Ms Lyandra Lee, with Chief Fisheries Officer, Mr Alwyn Ponteen

Together with the tablet application reports can be run very quickly (Fig 8): number of vessels fishing, number of fishing trips lost due to weather or other, landings weight per species, etc. These reports can be run on via the tablet application and through the database.

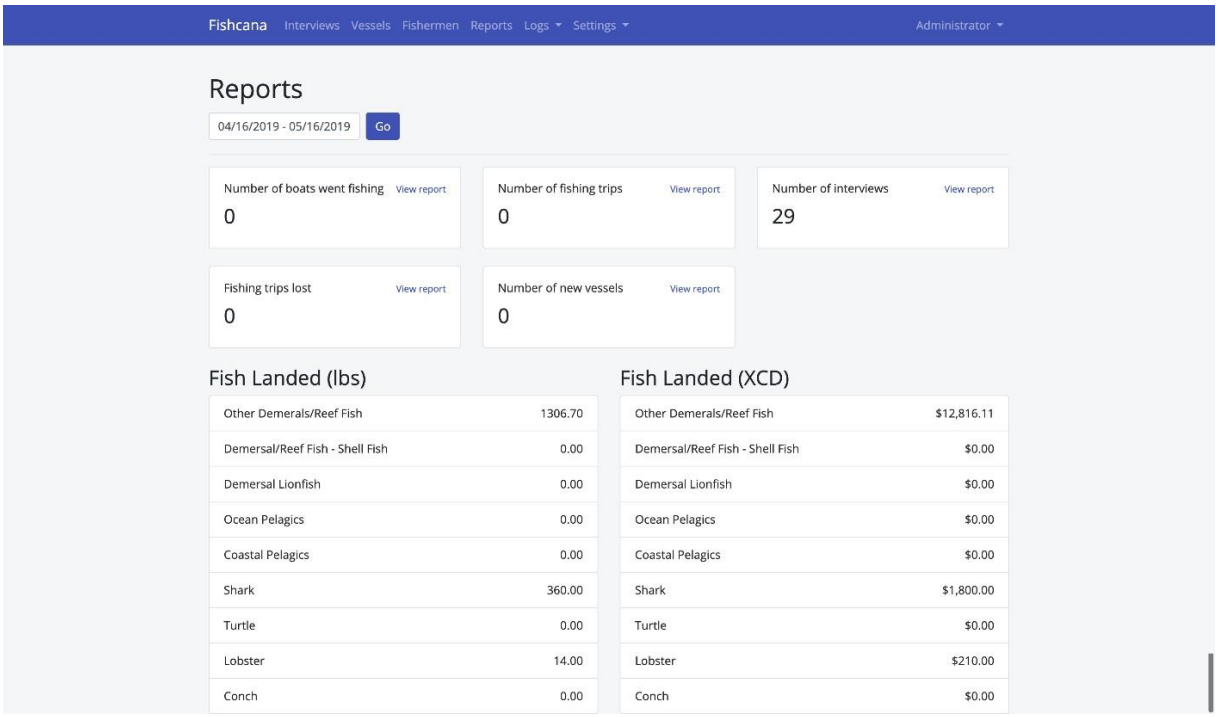


Figure 8. Example of fishery report

The Data Portal for Montserrat comprises two outputs which were combined for build ease and functional development. These being Output B: the development of the web-based mapping system and Output C: the website and interface. A contract was awarded to the South Atlantic Environment Research Institute (SEARI) for the development of both systems. SAERI have previous experience working with JNCC and Government of Montserrat to develop the Montserrat Metadata Catalogue and the metadata catalogue for the South Atlantic.

The aim to develop a common portal for Montserrat's data collection, management and use. These two new data management tools integrated old and new datasets. Working alongside the existing Metadata catalogue data can be held and converted into formats capable of use in the national GIS for spatial

mapping to support infrastructure planning and decision making. The new data portal was supported by a new server located within the Department of IT and eServices.

CKAN, the open source software on which the data portal is based, was customised to host the metadata schema used by GOM. The virtual machine containing the pilot version of the data portal, postgres database and the components of the webGIS data portal (QGIS server, postgres and lizmap), were provided to JNCC Head of IT for assembly into the physical server to test their compatibility with the Hyper-V virtualisation environment.

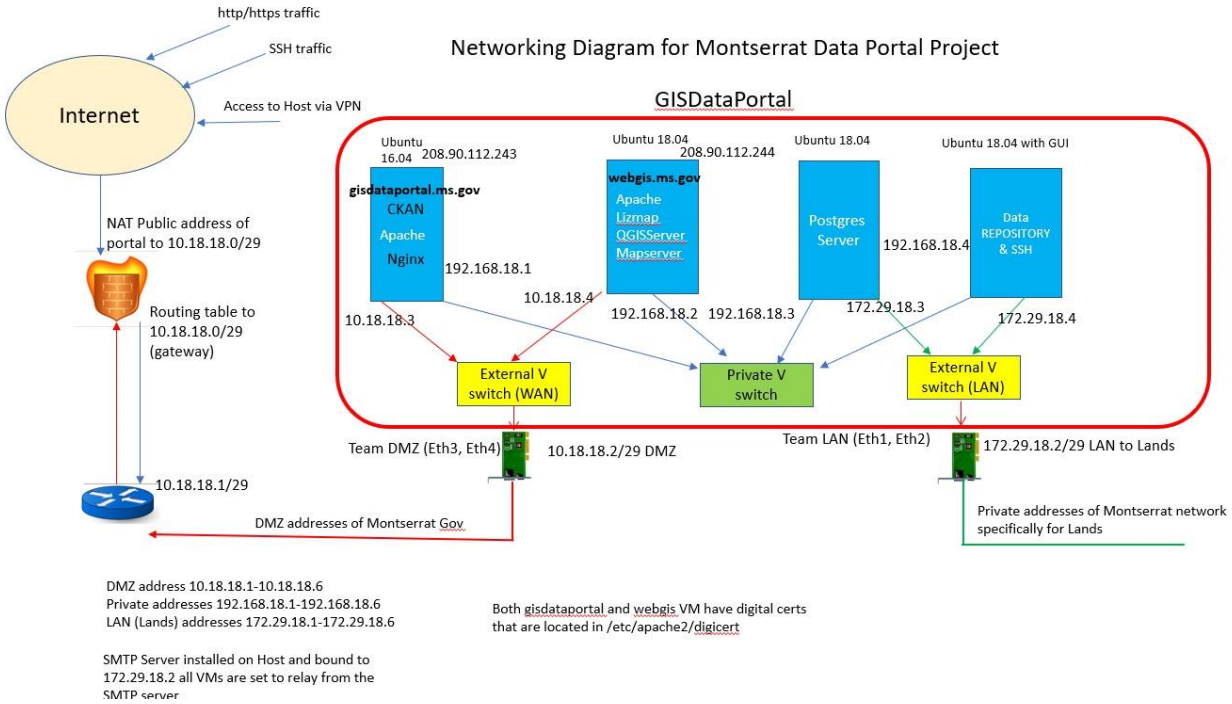


Figure 9. Final network diagram and IT system to host Montserrat's Data Gateway services

JNCC provided DITES with a Windows server containing four virtual machines (VMs) operated by Linux. These VMs are all sitting within Windows virtualisation environment, HyperV, and are accessible by the internal network of GOM (green lines in Figure 1) and by the external network (red lines in figure 9). As the diagrams shows, only the webGIS and data portals are public facing.

During the project two working visits by SAERI were planned. Scoping the project and final integration into the GIS Unit (see Fig 10). As with the fisheries work, the small size of the GIS Unit and DITES meant that additional travel to maintain project momentum was required. JNCC also travelled twice to Montserrat to collect data, ensure project was able to be delivered on time, to a high standard and to meet Government of Montserrat IT Safety standards.

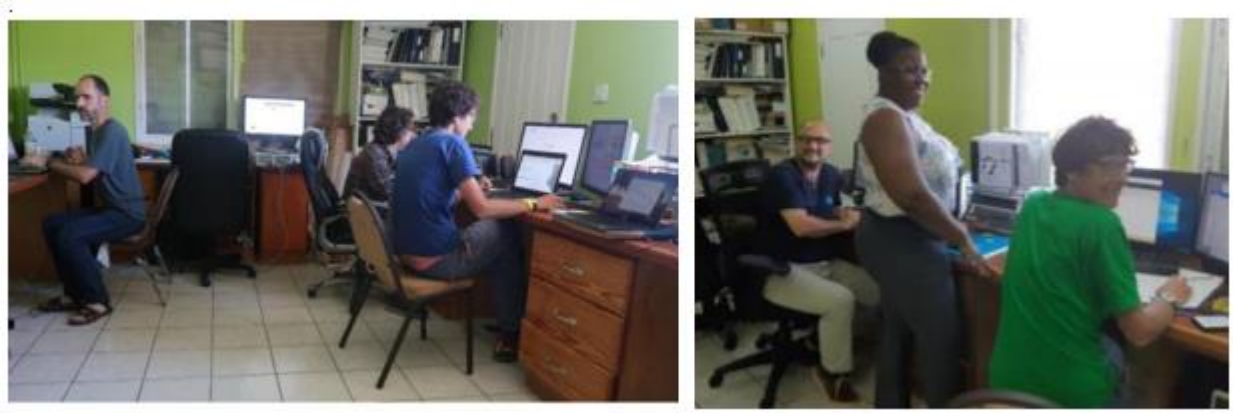


Figure 10. Dr iLaria Marengo, Mr Andrew Brooks and Mr Jorge Echevarria (left), and Mr Carl Cilenti, Head of GIS Mrs Lavern Ryan and Dr iLaria Marengo (right) building and testing Montserrat' Data Portal in the GIS Unit

The resulting work produced the two following outputs. Both are now live, running in Montserrat via the GIS Unit.

B. A web-based mapping system (Fig 11) for the display of spatial data to be hosted on Government of Montserrat IT infrastructure https://gisdataportal.gov.ms/

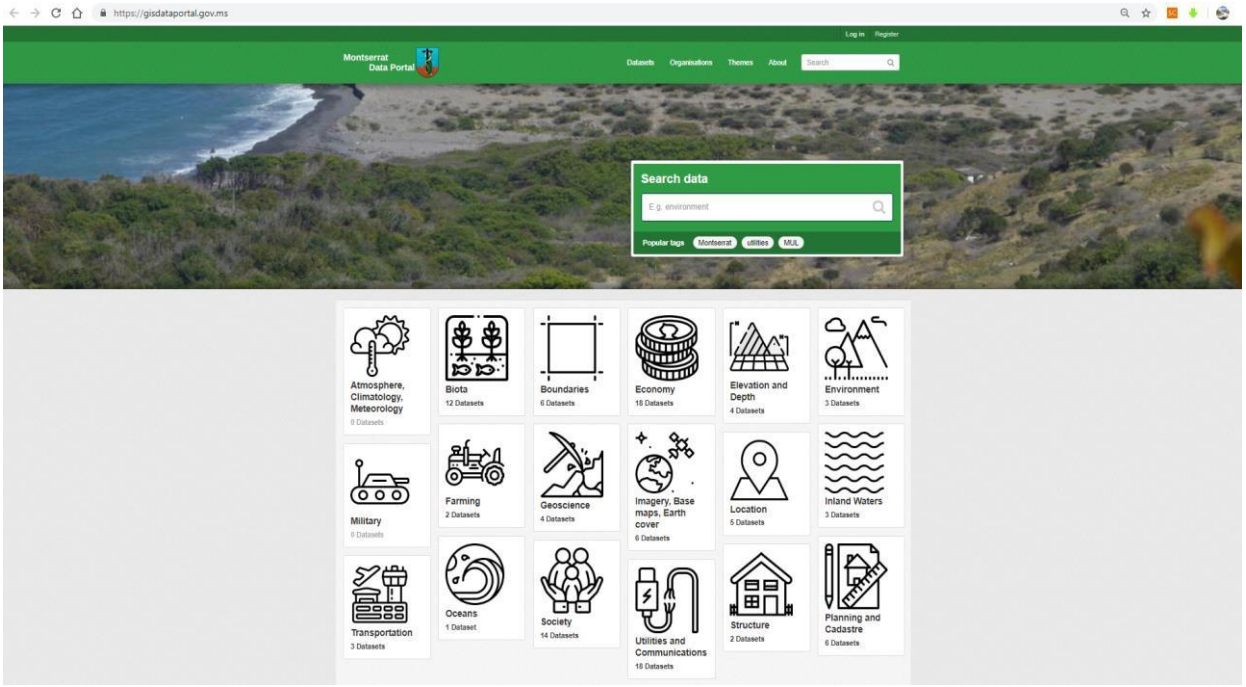


Figure 11. Montserrat web based spatial data portal

The Montserrat data portal currently holds 107 GOM datasets from 8 Ministry of Agriculture, Trade, Housing, Lands and Environment (MATHLE) departments with the GIS department providing the largest number (71).

C. A website and interface in the existing GIS unit (WebGIS, Fig 12) for:
   a. access to all data across its departments;
   b. data to be displayed and downloaded with a link to 'who to contact' easy access for decision makers and planners to integrate relevant data into decision making;
   c. data to include terrestrial, marine, spatial planning and governance data; and
   d. be accessible to the public. It is understood that some datasets should not be publicly accessed therefore the data portal will have agreed 'levels of accessibility'.

(https://webgis.gov.ms/lm/index.php/view/map/?repository=ms1&project=montserrat_web1_wu)

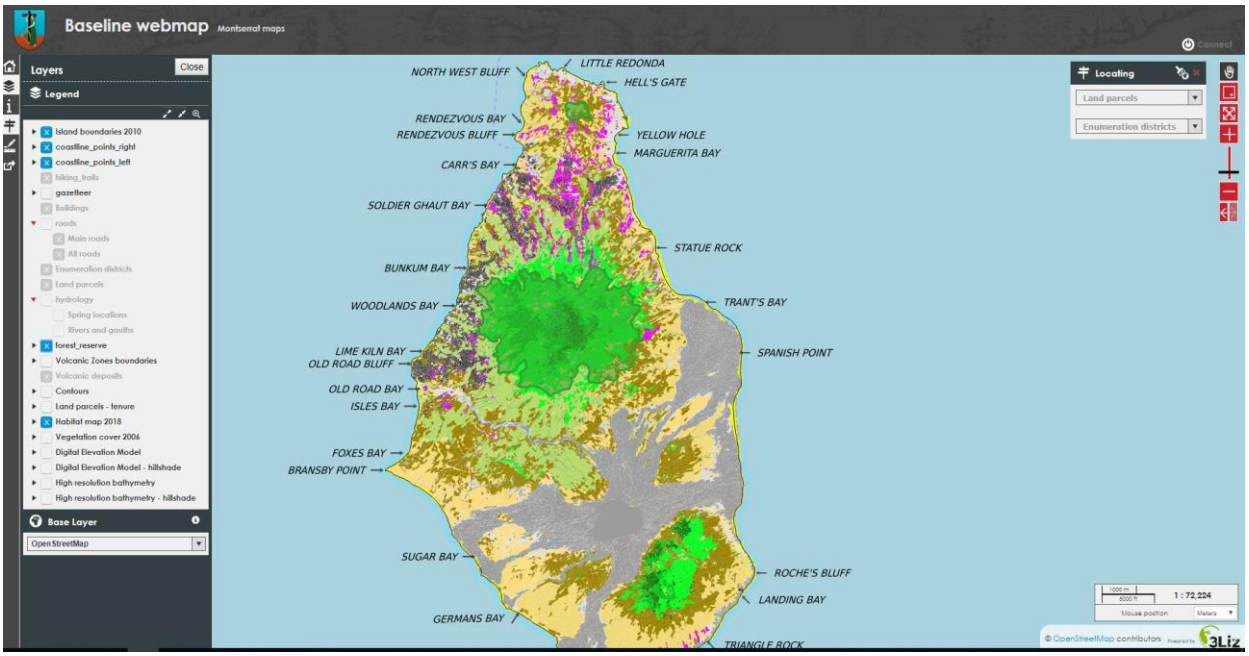


Figure 11. Screen shot of Montserrat's WebGIS

JNCC and SAERI worked in close collaboration with the GIS Unit to ensure that the Web-GIS contained all the required functionality, content and appearance as expected. Layer order and content of the abstracts, styles and links to metadata were included in the Web-GIS. The web-GIS was officially launched on 28 March 2019.

The data portal is also set up to allow the creation of users and access permissions for the datasets. For example, the data manager can open data to users belonging to a specific government department/specified organisation while the same data are kept restricted to everyone else.

Training the GOM officers in the use and understanding of both the data portal and the webGIS services was of paramount importance as both tools will be managed, and used, locally. The Head of GIS Unit undertook two days of 'on the job' training in WebGIS and the data portal (27 - 28 March). The on-the-job training was seen as imperative to put the data portal in context and to develop the specific skills required to manage the systems that have been set up in Montserrat. WebGIS training was provided for 2 additional GOM staff – Nicole Duberry and Rondell Meade, both key WebGIS users.

In addition, the Head of GIS Unit will run follow-up 'mini' training sessions with potential users to demonstrate the WebGIS to raise wider Government awareness about its availability and encourage wider and more regular interactions with spatial data across MATLHE and GOM in general. A programme for the training is now in development.

Remote follow-up training and 'call down' assistance was provided to GOM officers as required from April to July 2019 to enable a smooth transition to long-term sustainability on island.

D. A training programme to increase the capacity of on-island GIS and specialist GIS; enhancing physical (equipment) capacity on the island and human capacity through training programmes to ensure on-island capacity to use the data in the future

With the increasing volume and accessibility of data available to Government of Montserrat the GIS training programme focused on three areas:

- Increasing basic GIS understand through wider GoM and Montserrat stakeholders;
    - Train the Trainer programme for the Head of GIS Unit to further undertake wider beginner GIS training;
- Increasing intermediate GIS understanding through GOM; and
- Providing specialist GIS training.

Figure 12. QGIS training and certificates presented by Mrs Ryan (GoM) trainer of beginner level and Mr Manghi (SAERI) trainer beginner and intermediate level.

In order train a wider audience training centred around the use of open source GIS tools and platforms for managing and disseminating geographic information. Therefore, training focused on QGIS. Certificated QGIS training ran from 18-22 March 2019 in Montserrat. A two-day **beginner QGIS training** programme for 10 people was delivered by Mrs Ryan with training support from Mr Giovanni Manghi. This was followed by a 2-day **intermediate QGIS training** for 10 people delivered by Mr Manghi. A total of 16 people were trained across the four days. A broad cross section of GoM departments received QGIS training with software uploaded to participant laptops.

The training aimed to increase the overall GIS understanding in Montserrat, highlighting the use of spatial data, accessibility and different analytical techniques in the context of Montserrat. The concept and value of low-cost (free) software was discussed and considered across GoM. Within GoM ArcGIS is the main GIS analysis software used. Post training, wider understanding of QGIS and low-cost software is now being considered more widely.

Specialist training delivered included:

1. Train the Trainer QGIS basic and intermediate programme for Mrs Ryan, Head of GIS Unit. Mrs Ryan then delivered the beginner QGIS training supported by Mr Manghi. Mrs Ryan is now equipped and confident to deliver regular basic and intermediate QGIS in Montserrat.
2. Specialist QGIS attendance at the International QGIS User Conference 6-10 March 2019 attendance by Mrs Ryan (Fig 13).
3. Funding to support Mr Meade, GIS Officer to take a Masters in Geographical Information Systems and Science distance learning course run by Kingston University, January – December 2019. This is a challenging course introducing new programmes and methods for data formatting and analysis. Introducing remote sensing data has enable Mr Mead to use the high-resolution data purchased by JNCC and used in the CSSF funded natural capital project. Understanding statistics and analysis of statistical data, how to understand patterns and the use of various statistical methodologies is accelerating learning and understanding of the possibilities GIS presents for decision making in Montserrat.

E. An off-island data repository to function as a back-up data system to ensure data security in the event of hurricane or volcano damage to building and IT equipment; development of a cloud-based storage to ensure data security in the event of future natural disasters

Whilst scoping the project JNCC where made aware that the contract for fibre optic cabling was only just going out to tender. When installed and running this cabling will revolutionise data management, data flows, storage, analysis and disaster resilience in Montserrat. However, as the high-speed internet had not been delivered on time, as first projected (Feb 2018), it was not possible to deploy cloud-based back-ups. A duplicate server and data holding repository is currently under development between DITES and the Montserrat Volcano Observatory. This will provide some on-island data resilience once installed.

JNCC reviewed the scope of the project and agreed to work with DITES to facilitate future capacity and capability. This project, therefore, focused on immediate disaster recovery ahead of the 2019 hurricane season and providing data capacity for the forthcoming high-speed data services.

JNCC undertook analysis on GOM current data holding and scoped the projected increase in data needs for future. A server was purchased and configured in the UK and tests run with GoM data sets. Once running in the UK, with the Data Gateway, it was shipped and installed in Montserrat's Department of Information Technology and eServices (DITES). The installed server has inbuilt capacity to enable the virtualisation software and services (VEEAM) to be installed and configured. The architectural build capacity has also allowed the growing data holding and analysis needs and ensure that when the high-speed services come on-line cloud-based back-ups will be possible. The costs associated with the physical hardware (server) maintenance and servicing with HP have been set up to March 2021 providing a zero-cost option to GoM.

Ahead of the 2019 hurricane season a second server was purchased and configured as a working replica of the DITES serves. Additionally 2 high-capacity external hard drives were purchased to enable the monthly exchange of data between DITES and JNCC to provide full off-island back up of the GIS Unit spatial data and related datasets.

F. Digitise key paper-based datasets to archive data currently in paper format within the digital system.

A scoping exercise of different scanners and software was run in parallel with the GoM prioritisation assessment of historic data for digitisation. The project purchased a high-resolution scanner, software, licences, monitor and necessary cabling. The scanner was set up and tested in JNCC prior to deployment within the Lands and Survey Department in March 2019. Ms Nicole Duberry, Surveyor identified the priority land registry records for digitisation (Fig 14).

Some records held in the Land Registry are subject to book worm, these are old records starting in the 1700's. Also, many records are suffering in the humid conditions of the storage room. These records have been identified as requiring additional treatment and storage which is outside the scope of this project.

Figure 14. Mr Carl Cilenti setting up the electronic equipment for digitising historic records (left top), priority historic Land Registry records from 1700's (top right), priority surveying records identified by Ms Nicole Duberry, with Mrs Ryan and Mr Cilenti (bottom left and right).

Records started to be digitised immediately and over the summer recess a student attachment will provide momentum to the digitising process and enable the historic records to be spatially linked in the national GIS. This process will continue until all records have been digitised.

The long-term condition of the historic records is still a concern and treatment and storage conditions need to be improved before the records are lost.

3.2 Outcome

The project aimed to develop a Data Portal for Montserrat comprising WebGIS, Data gateway, fisheries database and application for data collection – these have been developed and are now in use by Government of Montserrat staff.

All GoM technical staff received training whilst the products were in development, in order to ensure that they were fit-for-purpose, and once completed. Training in software updates, data upload and use of the data portal and webGIS and fisheries database and application training was undertaken.

Cloud-based disaster resilience processes have been enabled for all MATLHE spatial data. This includes purchase of high specification server with capacity and readiness for the high-speed data connectivity. Procedures are in place for data resilience ahead of the forthcoming hurricane season and will continue to be in place until cloud-based connectivity is established.

Beginner and Intermediate QGIS training reached 16 people from across GOM including: The Montserrat Customs & Revenue Service, Department of Environment, The Royal Montserrat Police Service, The Environmental Health Department, Ministry of Communication Works and Labour, The Lands and Survey Department, Montserrat Utilities Limited, Disaster Management Co-ordination Agency, the Physical Planning Unit, Statistics Department and Port Authority.

Mrs Ryan is now trained to teach beginner and intermediate QGIS. A programme is in development to reach out to a wider stakeholder group across Montserrat to run during 2019-20.

Mrs Ryan has received further specialist analytical skills training at the International QGIS conference and is now supported by Mr Meade who is receiving additional analytical training through the distance learning MSc in Geographical Information Systems and Science at Kingston University, London. This additional training will enhance the technical ability and capacity of the GIS Unit to format, store, access and use data.

The processes and procedures are now in place to digitise Montserrat's historic data. The priority is the Land Registry records which can now be linked directly into the national GIS. Training has been provided in the use of the software and the simplicity of the scanning equipment means that interns will be able to take this work forward during summer 2019.

3.3 Long-term strategic outcome(s)

The project has delivered impact and long-term outcomes for Montserrat:

- Raised awareness for the need to protect and secure Montserrat's data during natural disasters and set processes in place for the short and long-term for resilience in data management.
- The online Data Portal allows users to be made aware of all the publicly available datasets and those held by GOM and any restrictions in their use. The data portal not only ensures longevity of the data but also enables partnerships and working collaborations as it exposes the metadata (and the open data) to the public and gives them that visibility that can attract interest from researchers, NGOs and other public/private sectors.
- There has been, and will continue to be, a reduction in the time taken to respond to queries and requests about available data, thereby enhancing GOM efficiency and freeing time to support decision making. This is true for both Fishery Data Collectors and GIS Unit staff time.
- WebGIS is a tool that doesn't require any GIS knowledge making it accessible to all and in user-friendly ways. Having an open WebGIS enables easier access to, and therefore encourages for the use of, evidence in decision making across the GOM as a whole. The WebGIS will also increase transparency as it is open to wider
- The data portal and the WebGIS are based on open source, and therefore there are no long-term licensing charges or fees.
- Montserrat has a fully trained QGIS trainer who is currently developing a beginner QGIS training programme to be delivered in 2019/20. The Head of GIS Unit is now also supported by a GIS Officer with increase analytical capabilities.
- As part of its cross-Territory data management work, JNCC will link Montserrat into networks, regional or OT specific training programmes, workshops etc that are organised in the region to ensure sharing of best practice and skills within the regional UK OT community. Lessons learned from the project will be shared with other OTs and regional states

4 Sustainability and Legacy

Key successes

- The Data Gateway is now up and running and in use by the Government of Montserrat. This comprises the WebGIS and Data Portal. GIS Unit use these daily as part of their normal work.
- All capital equipment purchased is in use by GoM in DITES, GIS Unit, Fisheries and Ocean Governance Unit and Land and Survey Department.
- The webGIS will aid the GIS Department in providing visualization of datasets to other users as well as enhancing the role and function of other Departments in their use of Spatial data for decision making within the Government of Montserrat
- Following the specialist QGIS and Train the Trainer training Mrs Ryan participated in the International QGIS User Conference. The experience and exposure gained has increased confidence to deliver training across Montserrat and a programme of training is now in development for delivery during 2019-2020.
- The new skills and knowledge base have also played a significant factor in Mrs Ryan being recruited as volunteer for the UK based charity, MapAction. Mrs Ryan now has the opportunity

to contribute to the support given in humanitarian emergencies around the world, through the use of geospatial technologies.

- Mr Meade is half way through the MSc and able to undertake more technical GIS analysis within the GIS Unit.
- A comprehensive record of all the datasets available for the Ministry are now linked with the actual data and all open datasets can be previewed and downloaded from this facility
- Capacity and technical expertise has been built locally with the GOM GIS Team being actively learning and directly responsible for future updates to the system. Knowledge can be easily transferred to other stakeholders on island.

5 Lessons learned

Challenge 1:
Due to small departments with a wide portfolio of work made agreeing and holding remote meetings often difficult and many times without a full complement of working group stakeholders. Government staff are often overseas at regional meetings or training events so timetabling and ensuring good coordination is essential.

Solution:
1. More targeted meetings, focusing on specific areas which required trouble-shooting and/or problem solving worked well and reduced technical discussion time within wider project board meetings.
2. Interim visit to Montserrat by JNCC staff also helped focus discussion, work and ensured continued project engagement and progress. This was particularly useful for ensuring IT functionality between the GIS Unit and DITES.

Challenge 2:
Ensuring new server configuration and GIS software was compatible with national systems, connected to national IT (within DITES) and appropriate security was in place; Linux operating systems running on a Windows server.

Solution:
1. Project partners held frequent detailed discussions to identify a solution to allow the four data services running on Linux in a server operated by Windows. The project required the data services to be run using open source software – the aim to reduce costs, enable free upgrades and ensure the continued use of systems. JNCC developed the final design of IT operating system, tested this within the JNCC offices before deploying to Montserrat. Virtual networking has enabled JNCC head of IT to work with DITES to support a smooth transition.

When taking forward a data management project it is essential to have the OT GIS Unit and Department of IT and eServices engaged.

Challenge 3:
The UK financial year placed additional burden with the need to deliver final products and training. This meant that there was a flurry of activity during March.

Solution:
By training the Head of GIS Unit to be able to Train beginner QGIS has enabled the training to be delivered wider and over time beyond that scope of the project. Training in open-source software updates will enable GOM to manage and lead their web-GIS and portal development at a time and speed that suits them in the future.

Challenge 4:
Due to time constrains and with project delivery in March some detailed aspects of training were not possible for the Data Gateway updates. While the project partners are supporting GOM staff post project distance learning about complex systems is not ideal.

Solution:
JNCC is working with GOM to identify face-to-face training opportunities which may come up through other project work. In the meantime, virtual training is ongoing.

This project is seen as a first step in the process to enabling the Government of Montserrat to find, access, store, secure and analyse territory environmental spatial data.

5.1 Monitoring and evaluation

The biggest change to the project was in the cloud-based disaster resilience work package. The delay in going out to tender for the high-speed connectivity meant that delivering a cloud-based recovery system was not possible. However, JNCC worked with the Government of Montserrat to develop virtual systems and server capacity and capability to enable cloud-based data storage once high-speed connectivity is established. In the short-term processes are in place to ensure spatial data is held in the UK on a replicate server with data transferred monthly by external data drives.
DITES are ready for data connectivity and continued support from JNCC has been agreed to support GOM in the transition to cloud-based systems.
The monitoring and evaluation plan helped ensure work packages were on track and milestones met.

6 Value for Money

Sound data management underpins and supports evidence-based decision making. This project has enabled Montserrat to identify, access, store, manage and visualise their existing spatial datasets. Making the datasets available in a visual way across the Government of Montserrat and globally has already enabled universities from across the world to request data for research. In Montserrat, awareness of the existing datasets, gaps in data and how they can be used is creating wider discussion.

Demonstrating the use of open-source products such as QGIS and CKAM (for the data portal development) has opened discussion to enabling a larger number of GIS users across Montserrat. This means more GoM staff will be able to access and visualise their data so enabling better and more consistent use for decision making.

The Data Gateway is now in daily use in the GIS Unit. The new fisheries database is used daily for recording fishery landings captured on the tablet applications. These new applications and systems have increased efficiency, freeing up staff time and reduce the risk of error in transposing data from paper to datasheet in the fisheries unit.

The portal that has been developed for Montserrat can easily be rolled out to other Overseas Territories. St. Helena have expressed an interest in having something similar, and it is SAERI's intention to 'roll out' the model to the Falkland Islands.
The Financial Memorandum of JNCC Support Co states that all procurement by JNCC should be designed to secure value for money. Achieving value for money in procurement is achieved through use of competitive tendering, or through use of Crown Commercial Services approved suppliers - we followed all procurement processes to deliver value for money.

Annex 1 Standard Measures

Code	Description	Totals (plus additional detail as required)
Training Measures		
1	Number of (i) students from the UKOTs; and (ii) other students to receive training (including PhD, masters and other training and receiving a qualification or certificate)	i. 1 MSc GIS & Science ii. 10 certificated training in beginner QGIS iii. 6 certificated training in intermediate QGIS
2	Number of (i) people in UKOTs; and (ii) other people receiving other forms of long-term (>1yr) training not leading to formal qualification	i. 1 Specialist training in QGIS ii. 1 received Train the trainer programme for QGIS beginner and intermediate iii. 4 fisheries data collectors
3a	Number of (i) people in UKOTs; and (ii) other people receiving other forms of short-term education/training (i.e. not categories 1-5 above)	i. 30 primary students trained fishery data collection & application use
3b	Number of training weeks (i) in UKOTs; (ii) outside UKOTs not leading to formal qualification	1
4	Number of types of training materials produced. Were these materials made available for use by UKOTs?	QGIS training manual
5	Number of UKOT citizens who have increased capacity to manage natural resources as a result of the project	18
Research Measures		
9	Number of species/habitat management plans/ strategies (or action plans) produced for/by Governments, public authorities or other implementing agencies in the UKOTs	
10	Number of formal documents produced to assist work in UKOTs related to species identification, classification and recording.	
11a	Number of papers published or accepted for publication in peer reviewed journals written by (i) UKOT authors; and (ii) other authors	
11b	Number of papers published or accepted for publication elsewhere written by (i) UKOT authors; and (ii) other authors	
12b	Number of computer-based databases enhanced (containing species/genetic information). Were these databases made available for use by UKOTs?	2: fisheries database and database for webGIS - both in use by GOM

Code	Description	Totals (plus additional detail as required)
13a	Number of species reference collections established. Were these collections handed over to UKOTs?	0
13b	Number of species reference collections enhanced. Were these collections handed over to UKOTs?	0 additional benefit of improved data management is access to data which will support biodiversity
Dissemination Measures		
14a	Number of conferences/seminars/workshops/stakeholder meetings organised to present/disseminate findings from UKOT's Darwin project work	3 – on-island presentation and demonstration
14b	Number of conferences/seminars/ workshops/stakeholder meetings attended at which findings from the Darwin Plus project work will be presented/ disseminated	5
Physical Measures		
20	Estimated value (£s) of physical assets handed over to UKOT(s)	£22,163
21	Number of permanent educational/training/research facilities or organisation established in UKOTs	1 QGIS trainer (beginner and intermediate)
22	Number of permanent field plots established in UKOTs	0
23	Value of resources raised from other sources (e.g., in addition to Darwin funding) for project work	

Annex 2 **Supplementary material (optional but encouraged as evidence of project achievement)**

- • Montserrat training report - QGIS beginner and intermediate (PDF, 1.5Mb) (March 2019)
- • Montserrat data management - data gateway project report (PDF, 1.4Mb) (2019)
- • The Montserrat Data Management Project – Establishing a tool for providing a sound evidence base for Natural Capital Assessment in Montserrat (PDF, 0.7Mb) (March 2018)

Further fisheries training has been extended to junior school students during ***Girls in ICT*** day held in Montserrat in April 2019
Government Press Release from the Ministry of Communication, Works, Energy and Labour Facebook page stated;
"It aims to encourage and empower girls and young women to consider studies and careers in the growing field of ICTs, enabling both girls and technology companies to reap the benefits of greater female participation in the ICT sector.

This year MCWEL will be celebrating with the rest of the world, by taking our young girl on a field trip to various sectors across Montserrat, to look at how they are incorporating and using ICT, to carry out their functions."

Annex 3 ISO user manual for Fisheries application and database

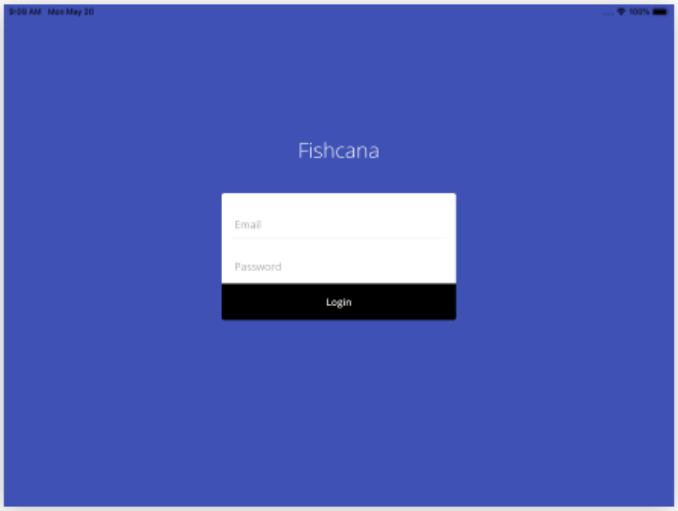
Fishcana

iOS Manual

Last updated: May 20, 2019

Table of Content

Login



To begin using the iOS application, login with your assigned email and password. Upon successful login, you will be presented with the interviews screen.

Forgot password?

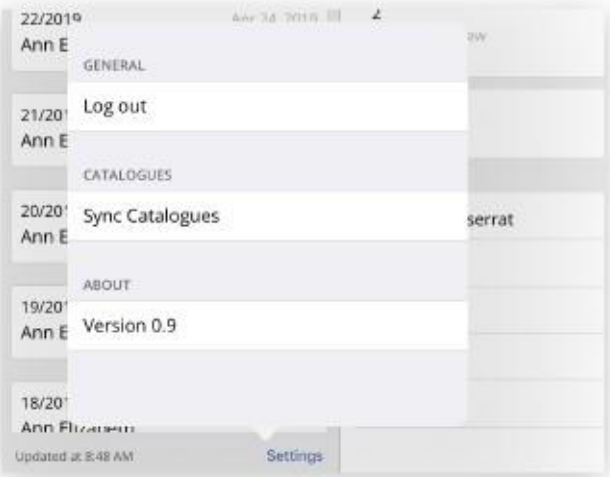
If you have forgotten your password, you can reset your password by clicking on the 'Forgot your password?' link on the login page of the Fishcana web application.

Need a login?

If you do not have an account, ask your system administrator to create one for you.

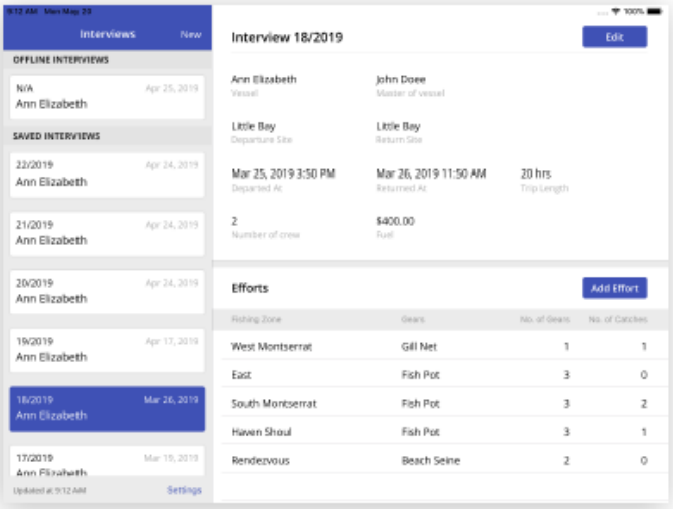
Logout

To log out, tap on the "Settings" link from the Interviews screen and then tap on 'Log out'.



Interviews

The interviews dashboard is divided into two panes; the left pane — displays a list of all interviews ordered chronologically, and the right pane — displays the trip and effort details of the selected interview.

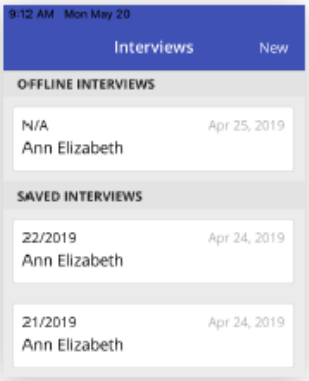


Interviews are grouped into the following sections:

1. **Offline Interviews**: these interviews persist locally on the iPad only and need to be synced to the centralized database for permanent storage.

2. **Saved Interviews**: these interviews have been saved permanently to the centralized database.

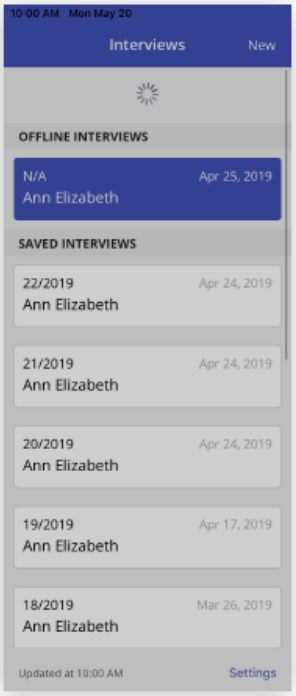
Interviews are automatically added to either section based on internet connectivity. When saving an interview, if the iPad has an internet connection, the interview is saved permanently to the centralized database; otherwise, it is stored locally on the device.



Updating interviews list

To update the interviews list from the centralized server — in order to get recently added interviews and to update exiting ones — scroll to the top of the list and pull down on the table until the activity indicator appears, release once the activity indicator makes a complete circle.

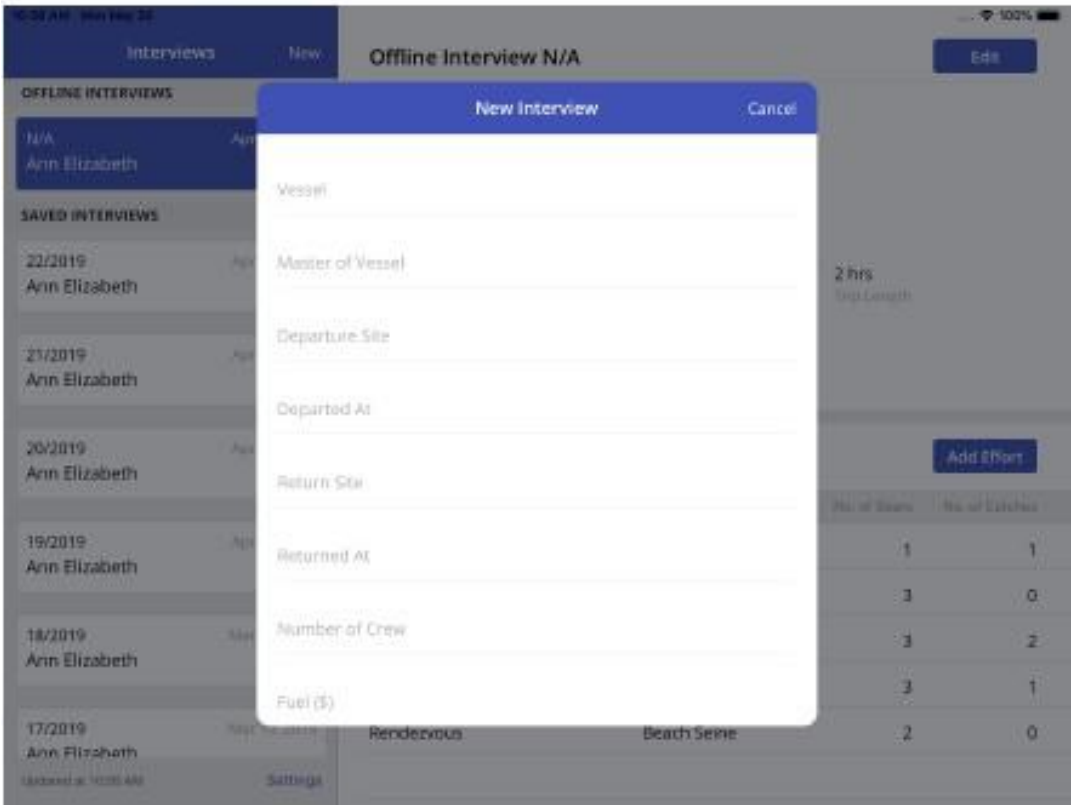
The timestamp on the toolbar will update to indicate the date and time the list was last updated.

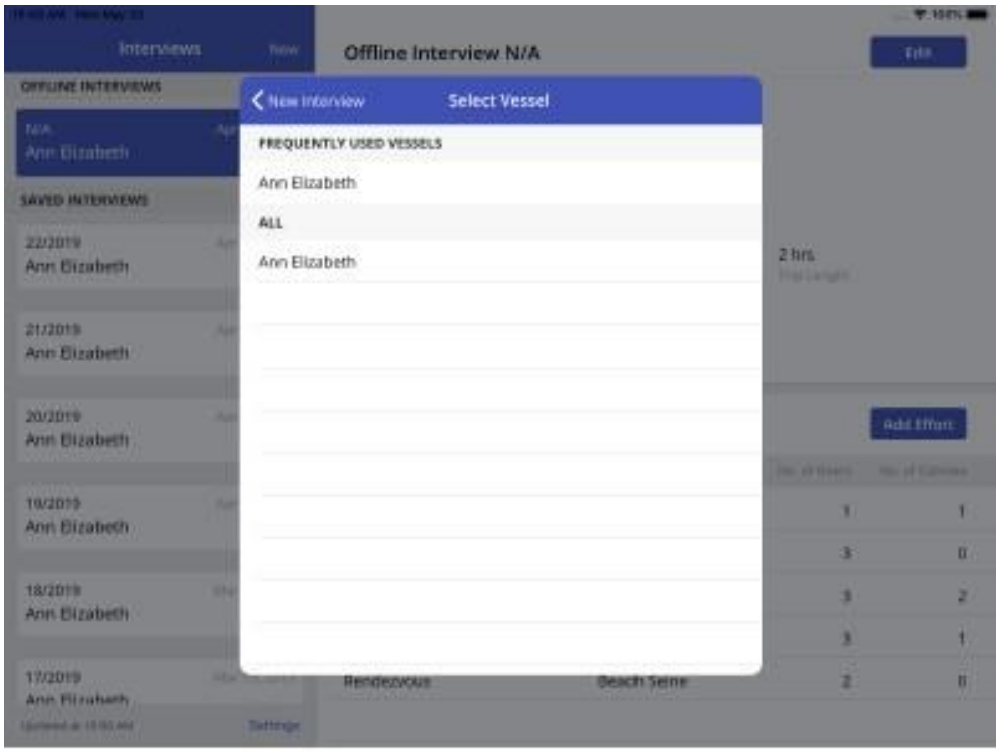


Creating an interview

Tap on the '**New**' button on the '**Interviews**' dashboard to open the '**New Interview**' form.

Complete the form by tapping on each relevant section by either selecting or inputting the necessary data.




Interviews
New
Offline Interview N/A
Edit
OFFLINE INTERVIEWS
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SAVED INTERVIEWS
22/2019
Ann Elizabeth
21/2019
Ann Elizabeth
20/2019
Ann Elizabeth
19/2019
Ann Elizabeth
18/2019
Ann Elizabeth
17/2019
Ann Elizabeth
New Interview
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Ann Elizabeth
ALL
Ann Elizabeth
2 hrs
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Rendezvous
Beach Seine
Settings


Interviews
New
Offline Interview N/A
Edit
OFFLINE INTERVIEWS
N/A
Ann Elizabeth
SAVED INTERVIEWS
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20/2019
Ann Elizabeth
19/2019
Ann Elizabeth
18/2019
Ann Elizabeth
17/2019
Ann Elizabeth
New Interview
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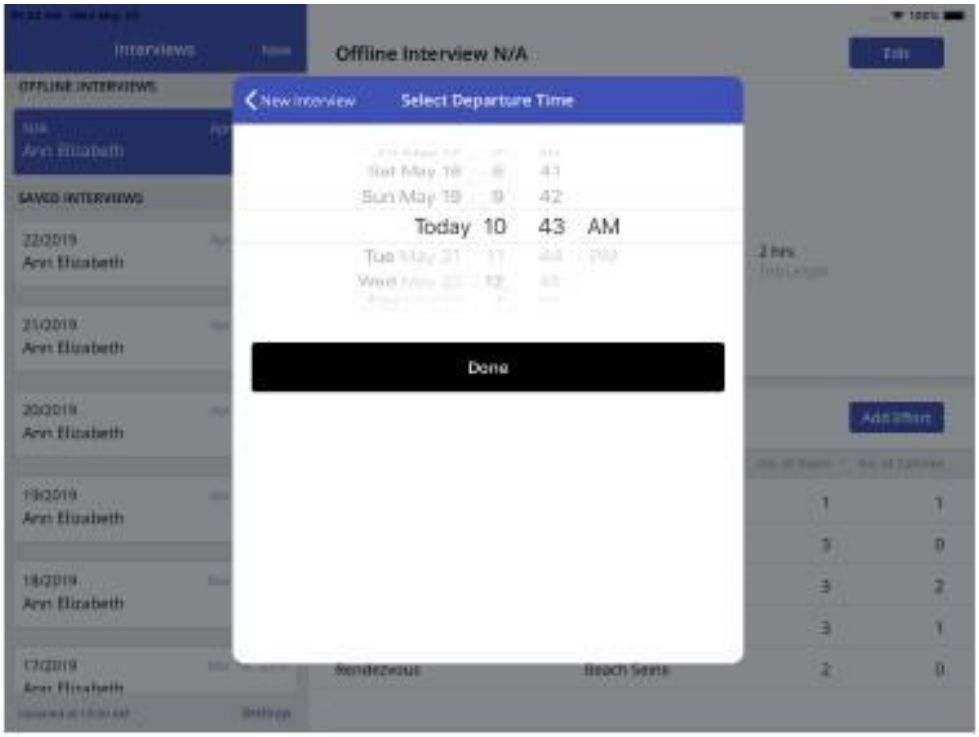
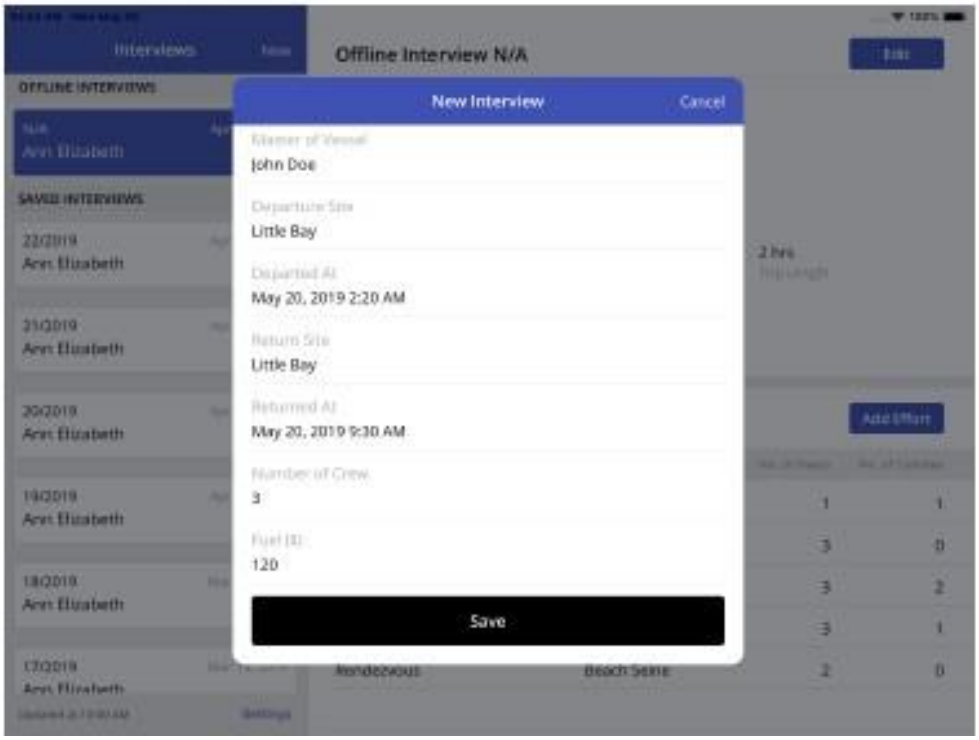
Carrs Bay
Isles Bay
Little Bay
Old Road
Woodlands
2 hrs
Add Effort
Rendezvous
Beach Seine
Settings

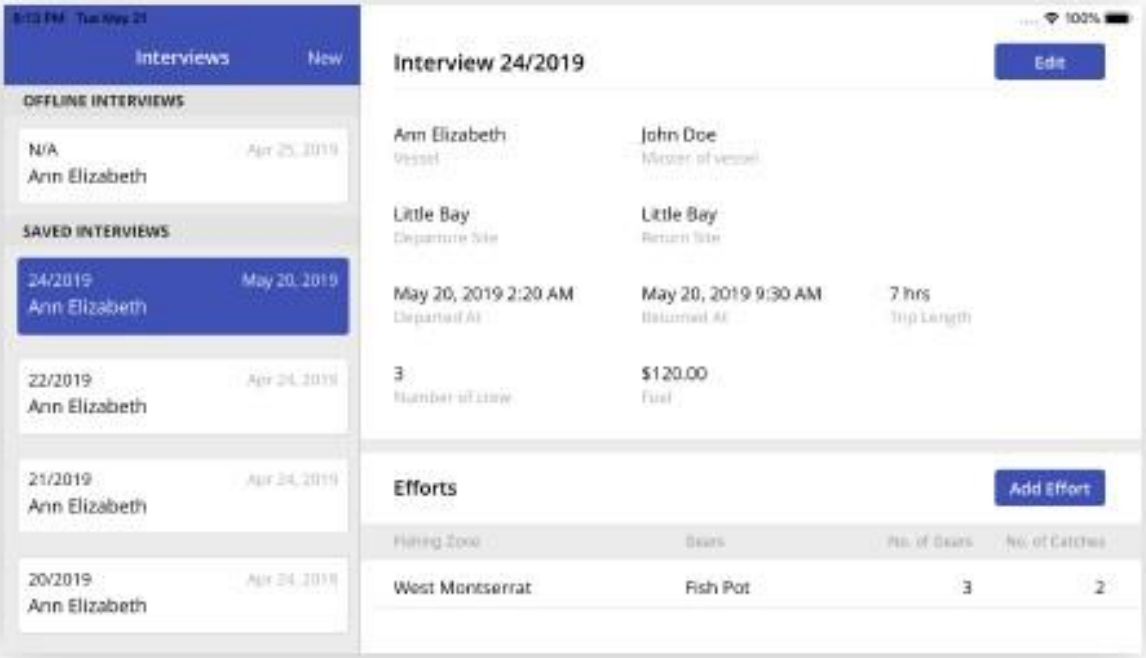


Tap the 'Save' button to save the interview. Once an interview is saved you may begin entering the effort and catch data.

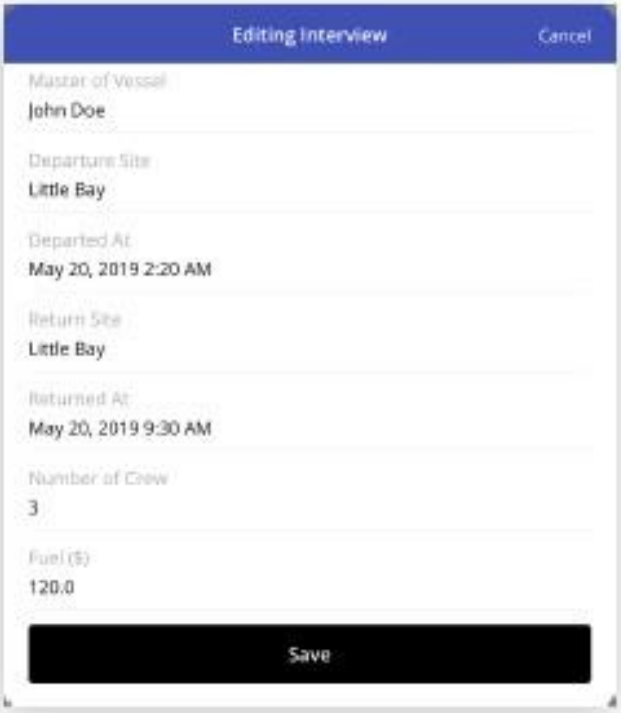


Editing an interview

From the interviews list pane, select the interview you would like to edit first, and then tap on the 'Edit' button on the interview detail pane.

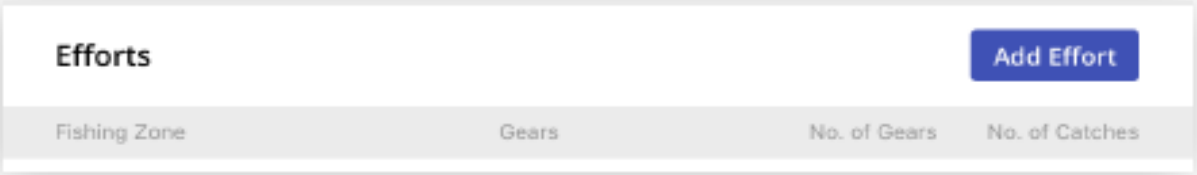


Update the relevant fields on the '**Editing Interview**' form, and tap '**Save**' to confirm the change(s).

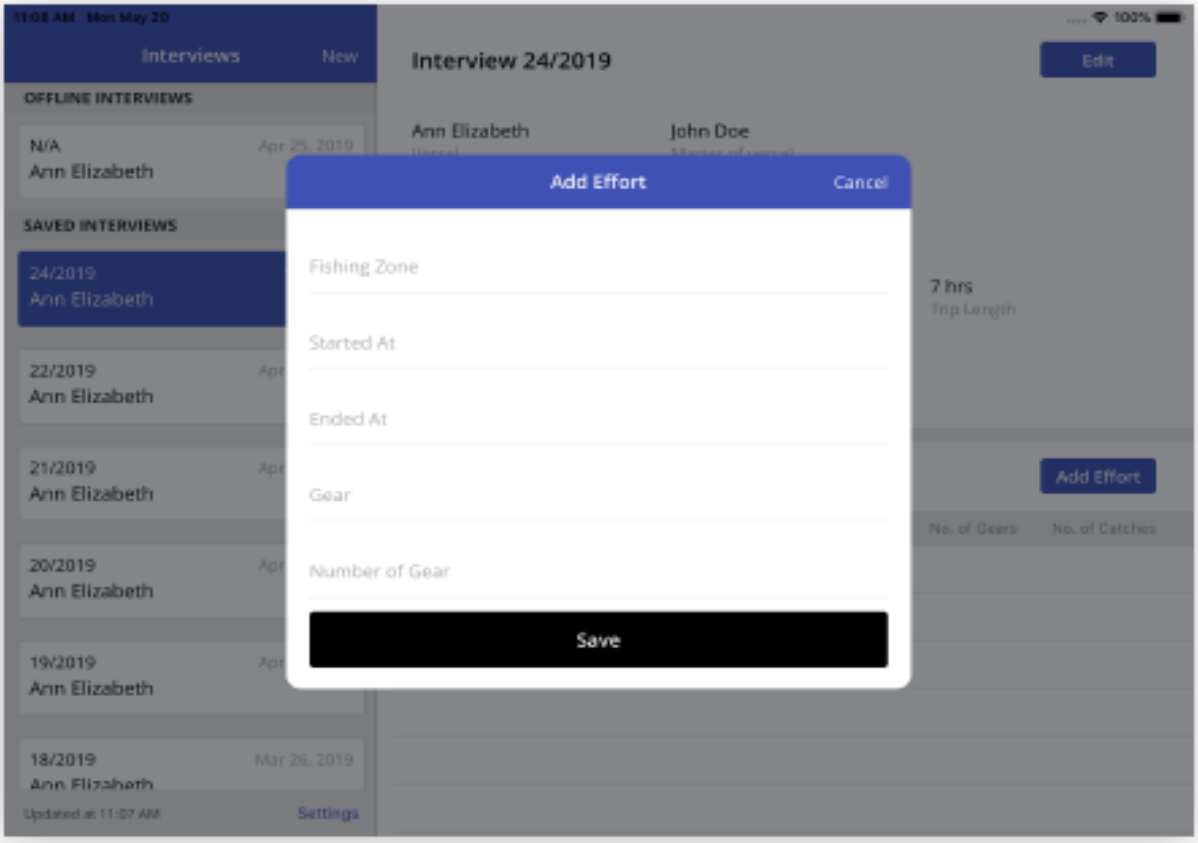


Adding an effort

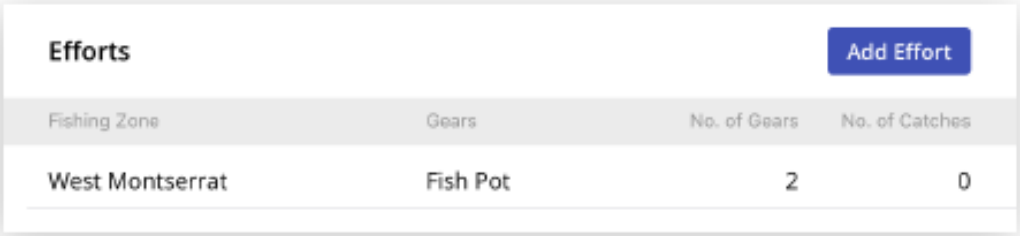
To begin adding effort data, tap on the '**Add Effort**' button from the interview detail pane to open the '**Add Effort**' from.

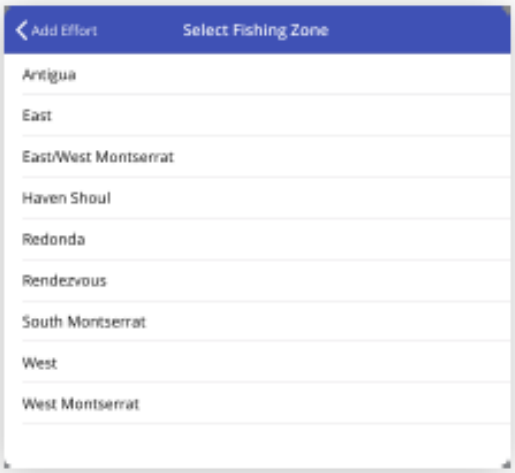


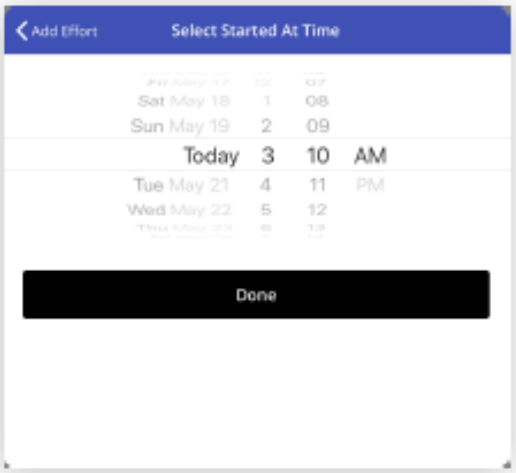
Fill-in in each field with the respective data, and then tap on the '**Save**' button to add the effort to the selected interview.

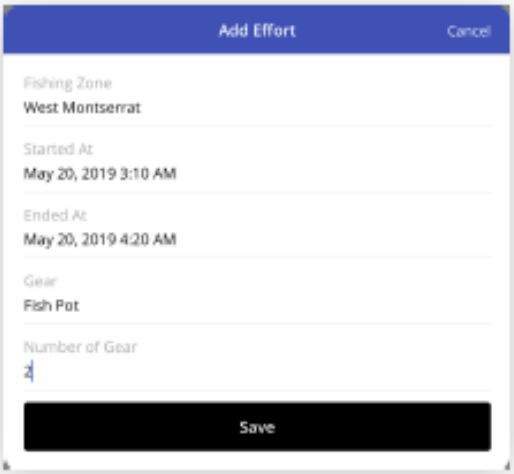


After the effort has been saved, it will appear on the efforts list.



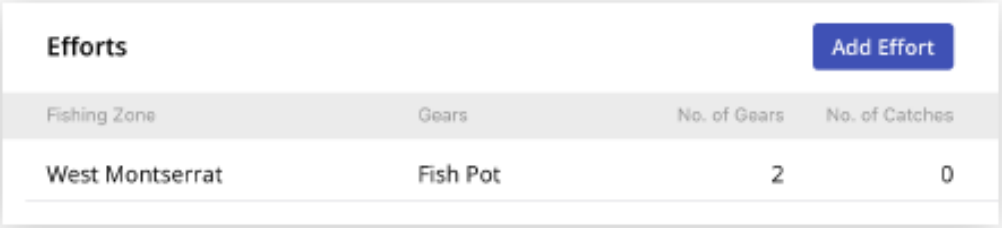




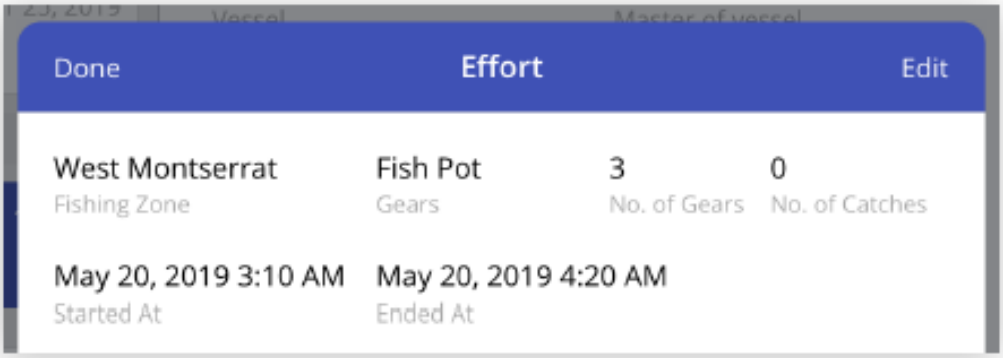


Editing an effort

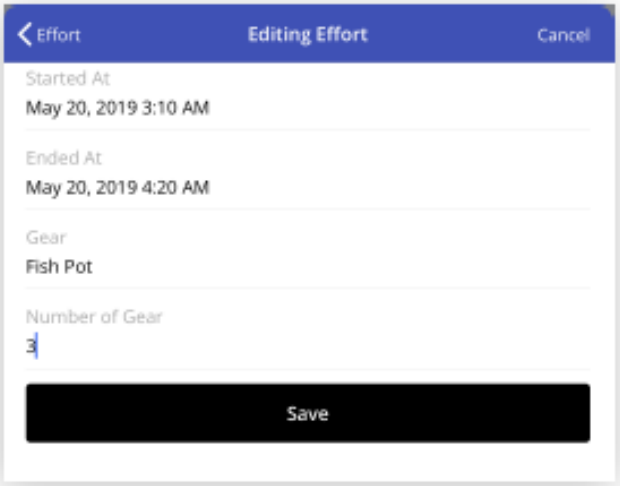
Select the effort you want to edit from the efforts list.



Tap on the '**Edit**' button from the navigation bar.

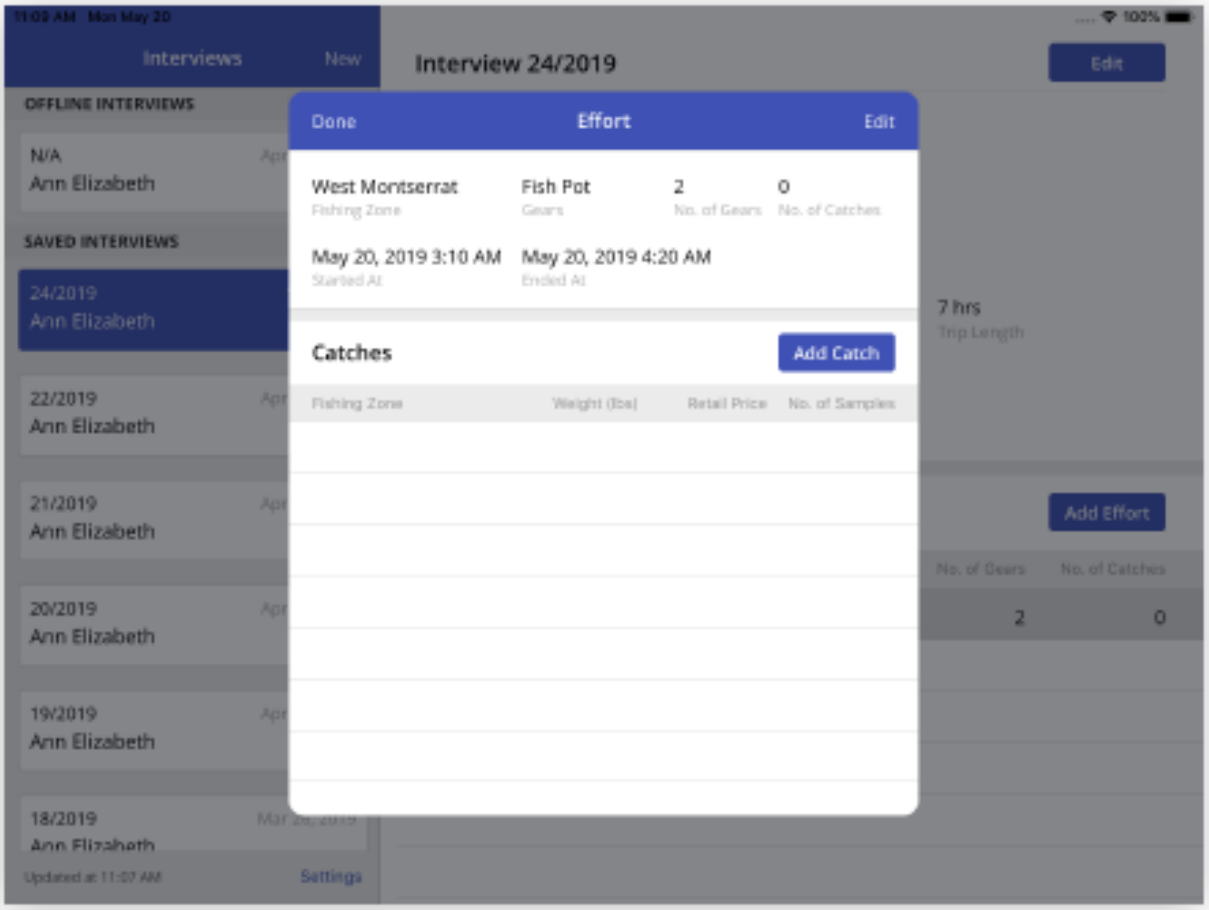


Update the relevant fields and tap '**Save**' to confirm the change(s).



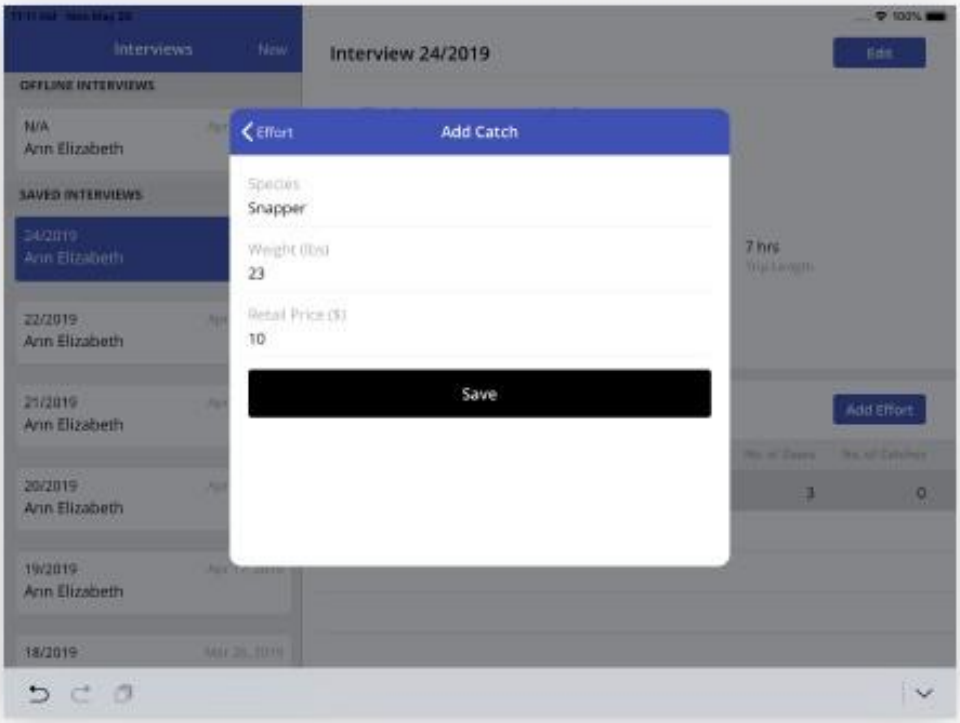
Adding a catch

Select the effort associated with the catch by tapping on the effort. This brings up the effort detail view.

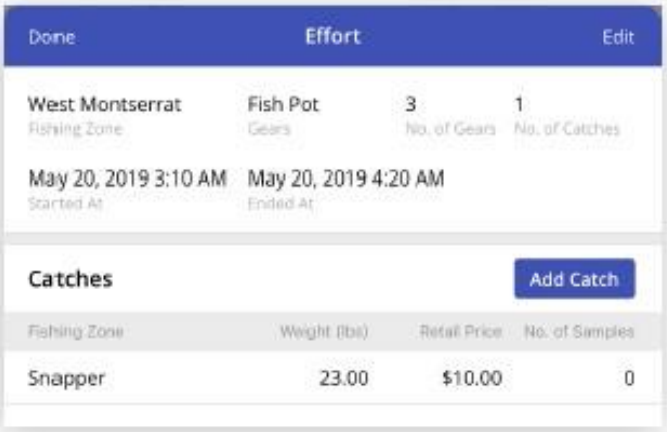


From this detail view, tap on the '**Add Catch**' button to navigate to the '**Add Catch**' form.

Select and insert the relevant data into the three fields provide, and tap 'Save' to add the catch to the effort.

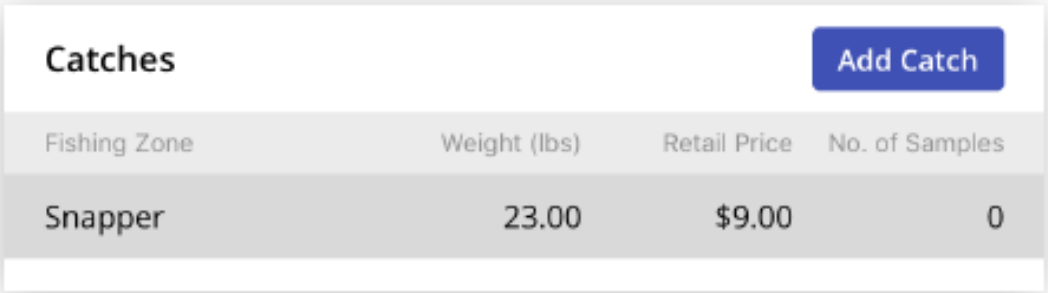


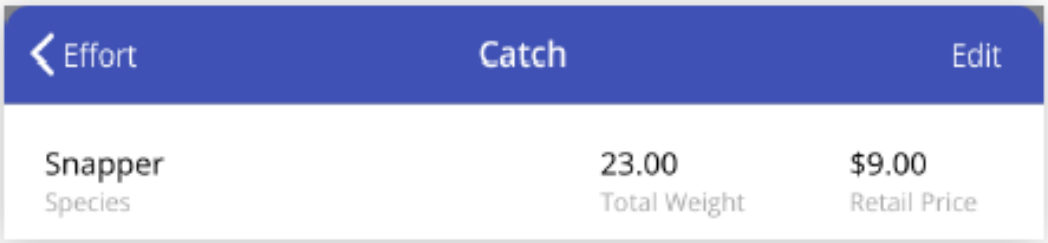
If successful, the catch will appear on the catches list.



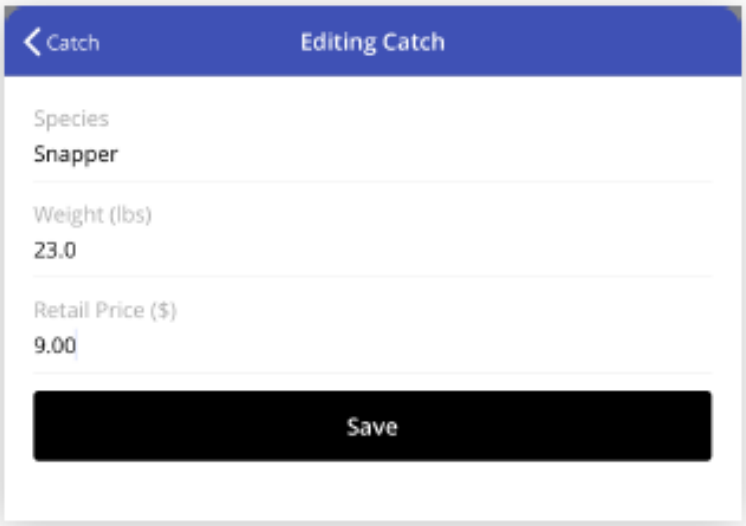
Editing a catch

Select the catch you would like to edit, and then tap on the '**Edit**' button from the catch detail views' navigation bar.



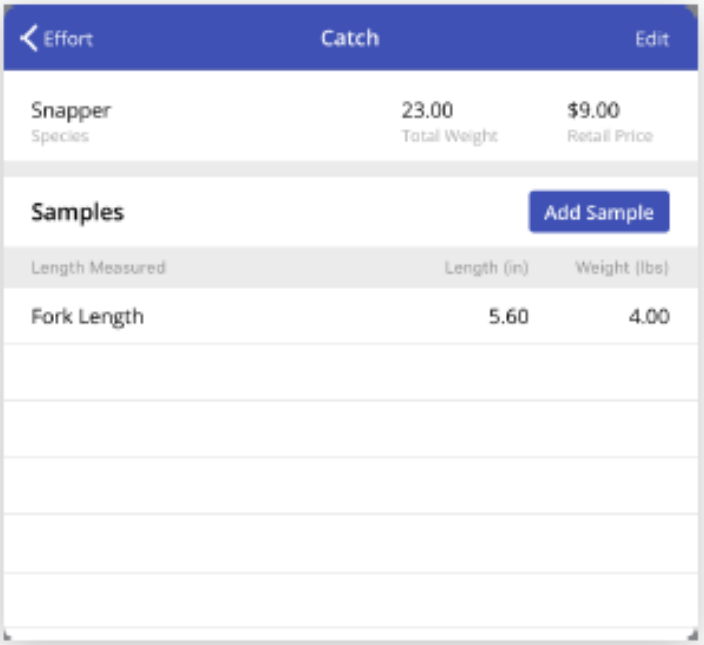


Update the relevant fields and tap '**Save**' to confirm the change(s).

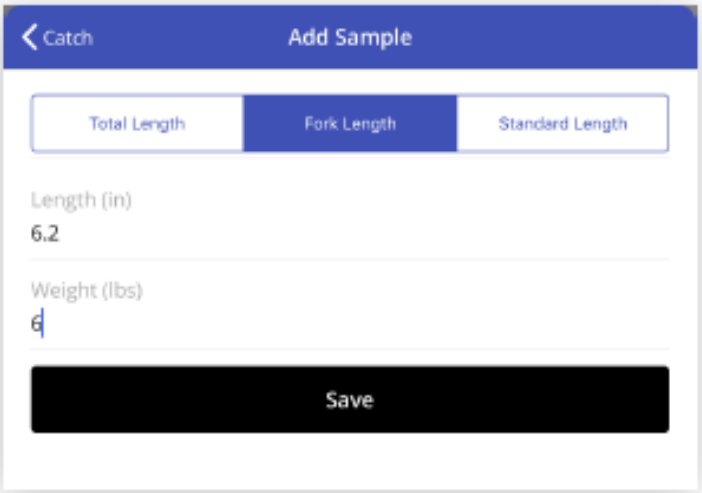


Adding a sample

To add sample data to a catch, tap on the '**Add Sample**' button from the catch detail view.

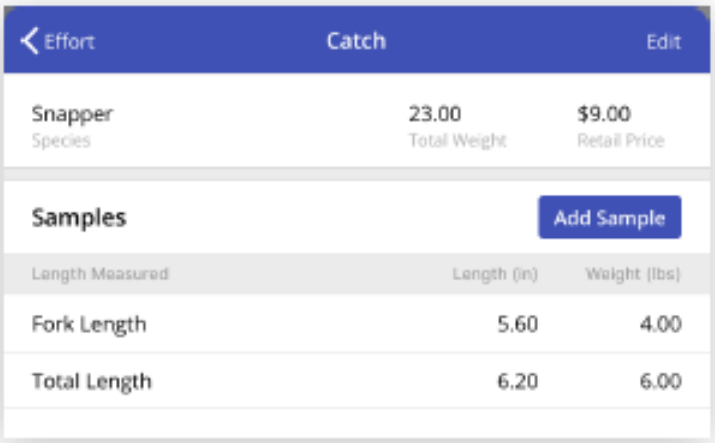


Fill in the relevant fields on the '**Add Sample**' form, and tap '**Save**' to confirm.

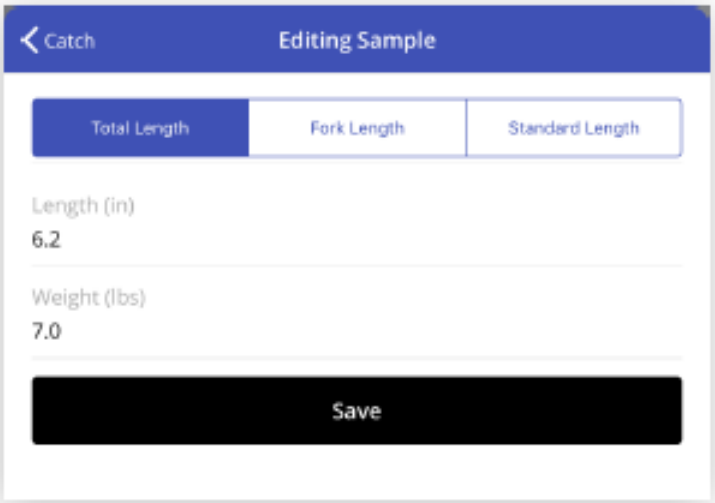


Editing a sample

To edit a sample, tap on the sample you would like to edit from from the samples list.



Update the relevant fields and tap '**Save**' to confirm the change(s).



Checklist for submission

	Check
Is the report less than 10MB? If so, please email to Darwin-Projects@ltsi.co.uk putting the project number in the Subject line.	
Is your report more than 10MB? If so, please discuss with Darwin-Projects@ltsi.co.uk about the best way to deliver the report, putting the project number in the Subject line.	
Have you included means of verification? You need not submit every project document, but the main outputs and a selection of the others would strengthen the report.	
Do you have hard copies of material you want to submit with the report? If so, please make this clear in the covering email and ensure all material is marked with the project number.	
Have you involved your partners in preparation of the report and named the main contributors	
Have you completed the Project Expenditure table fully?	
Do not include claim forms or other communications with this report.	