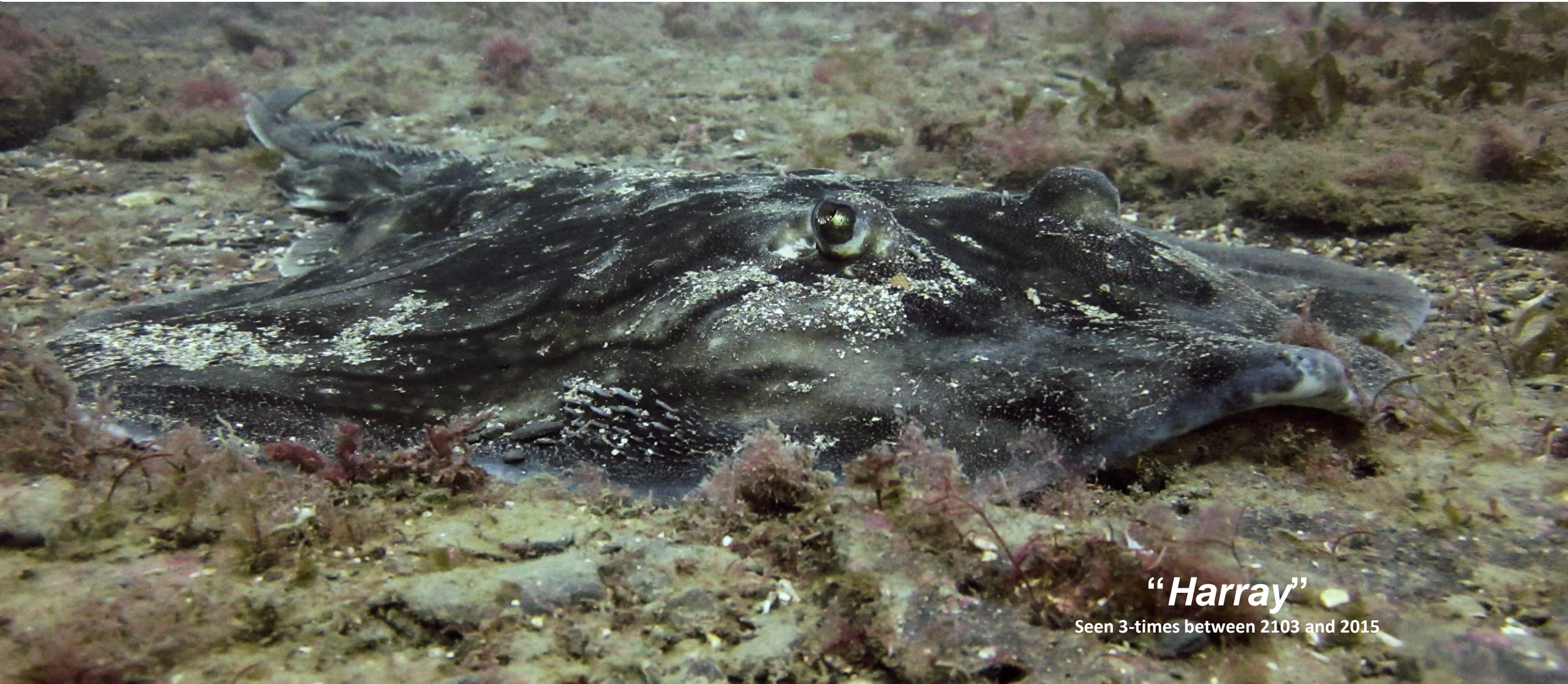




THE
UNDULATE RAY
PROJECT

The Undulate Ray Project

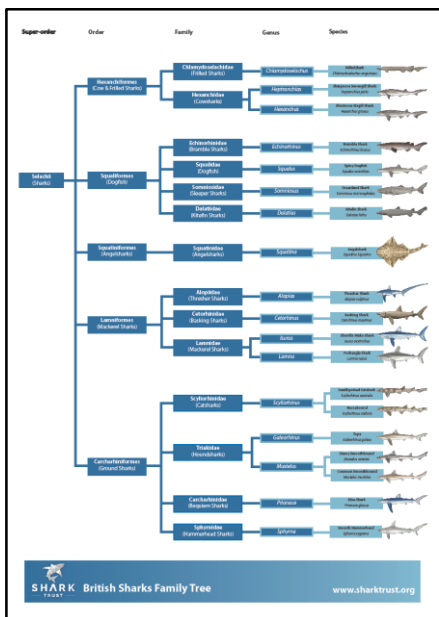
www.undulateray.uk



“Harrray”

Seen 3-times between 2103 and 2015

November 2017



www.sharktrust.org

Elasmobranch

Sharks

Skates

Rays

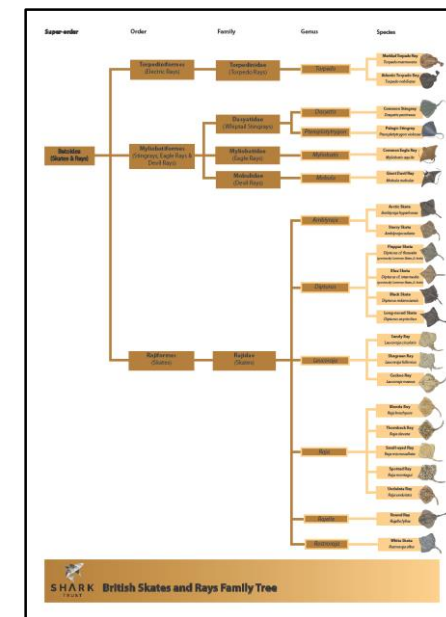
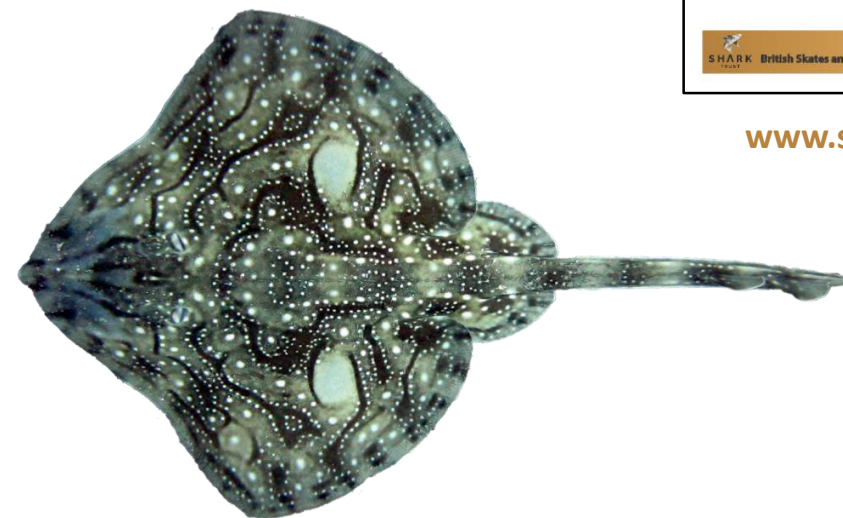
Raja brahcyura
Blonde Ray

Raja clavata
Thornback Ray

Raja undulata
Undulate Ray

Raja microocellata
Small-eyed Ray

Raja montagui
Spotted Ray



www.sharktrust.org

“Undulate” because of the movement of their wings when they swim

- one of five species of “Flat Shark” or skate commonly found on the south coast



Abundant in some local areas

- concerns exist about their long-term survival

“Erayc”

Seen in June, July and August 2017

Undulate Rays



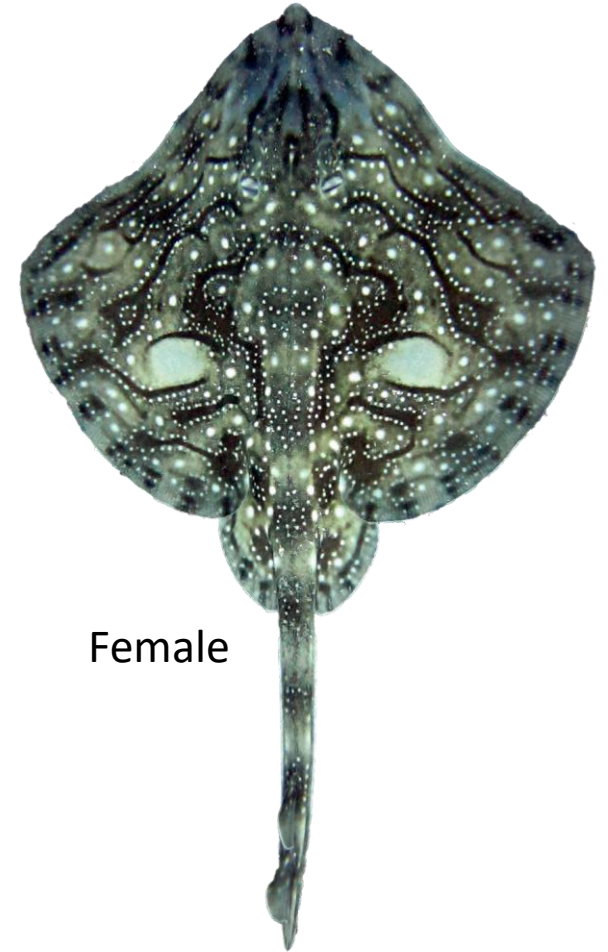
Male

Grow to approximately 1-metre in length
Live for about 15 to 20 years?
Mature at about 8 years old
Diet: mostly small crustaceans

Breeds between March and June
- possibly longer?

Lays eggs in pairs
- where?
- over what period?

Incubation thought to take about 90 days



Female

Ray Identification



"Garay" 27 August 2013



"Garay" 3 September 2013

"Garay" on 2 separate days – to be sure this is the same fish ...

Ray Identification



"Garay" 27 August 2013



"Garay" 3 September 2013

... we rotate the image to the same direction and remove the colour ...

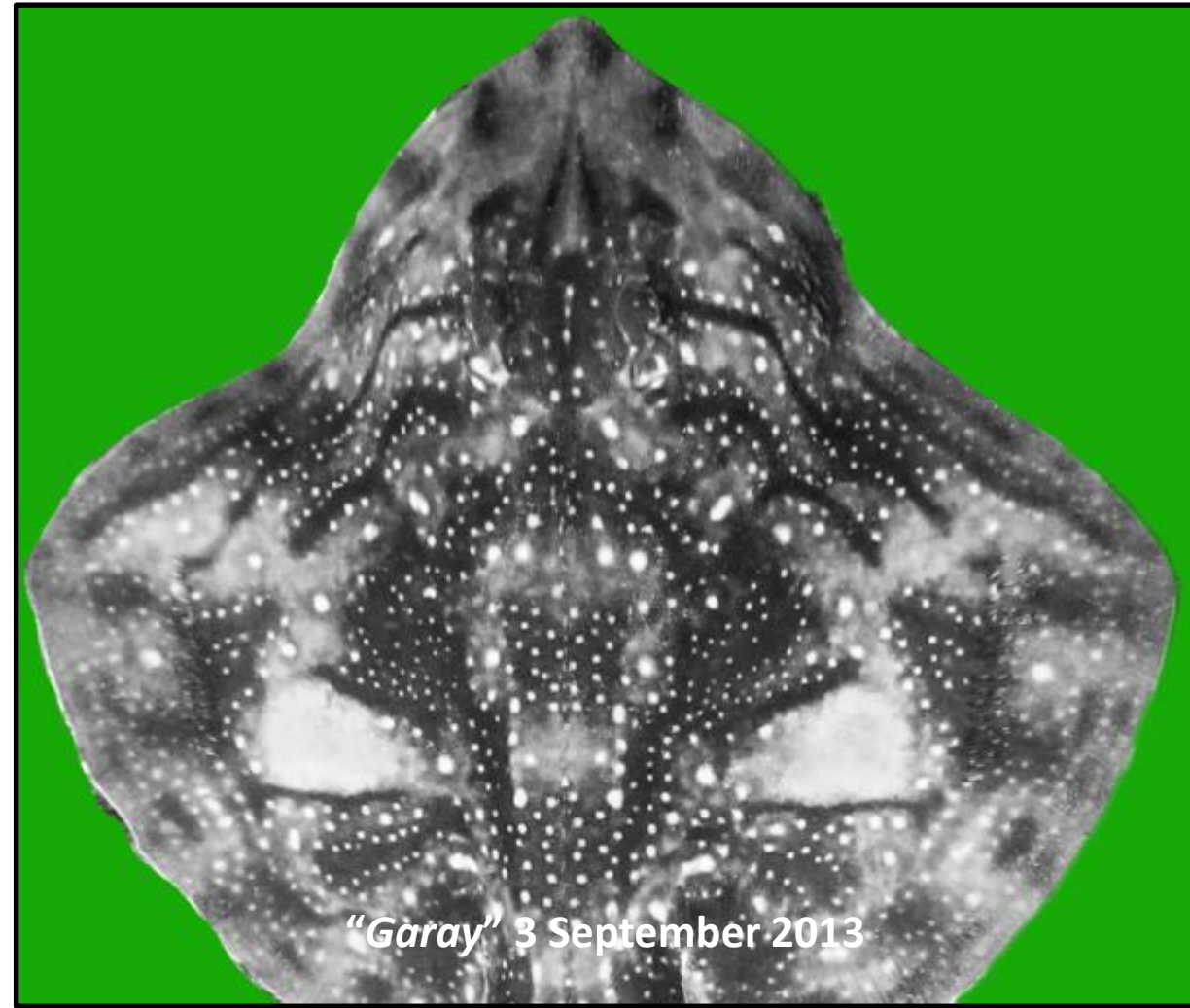
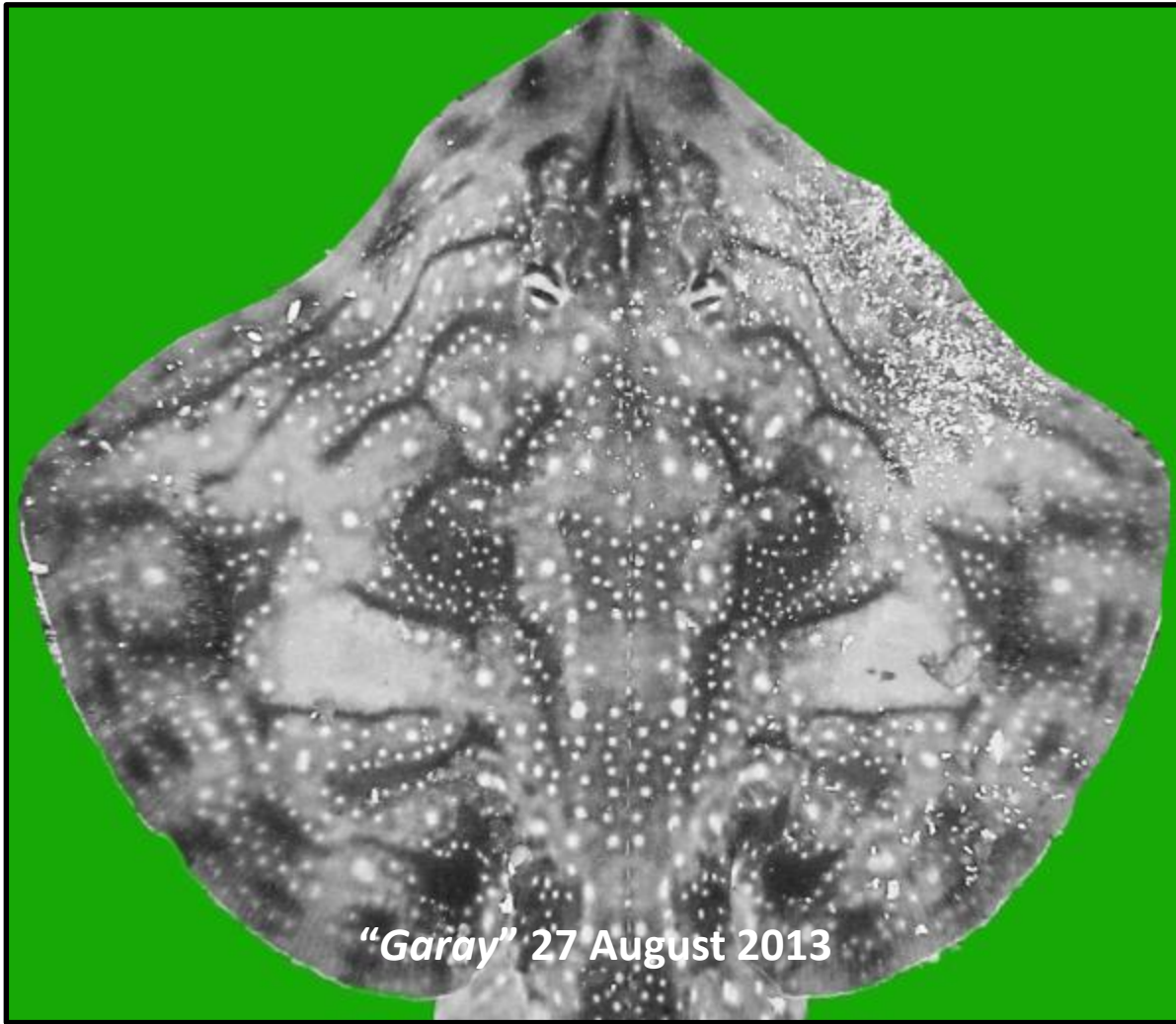


"Garay" 27 August 2013



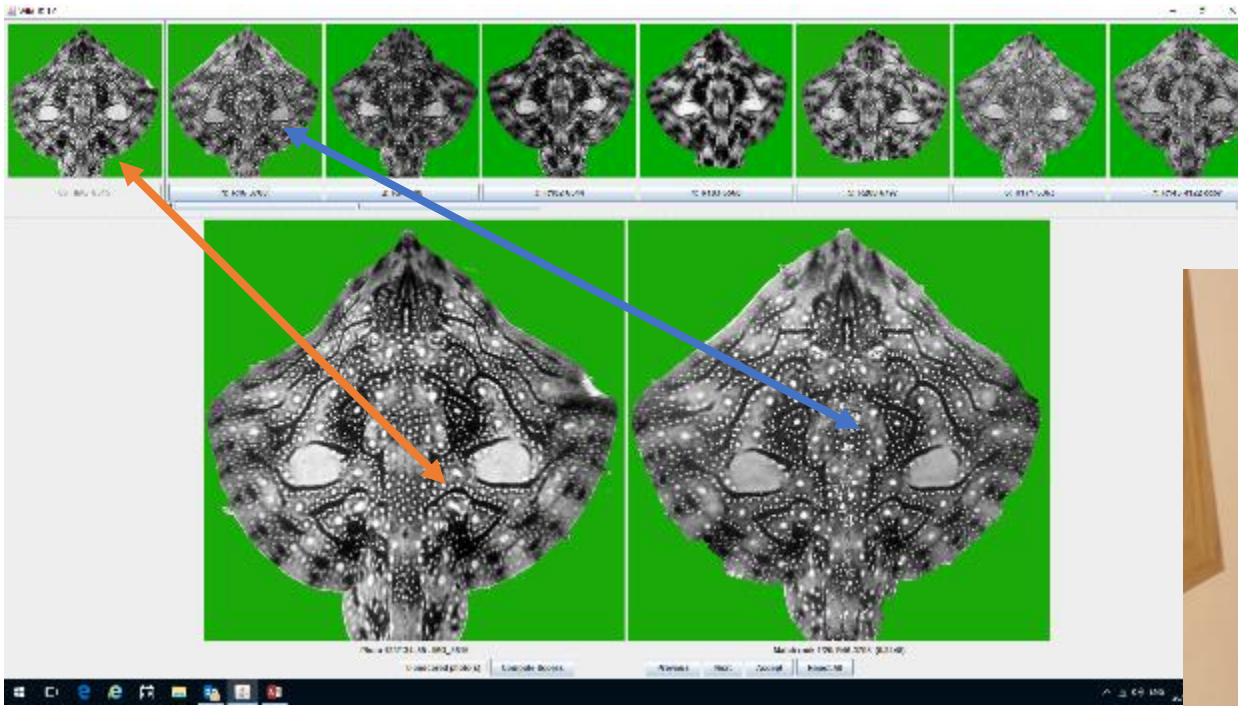
"Garay" 3 September 2013

... crop and resize ...



... and remove the background.

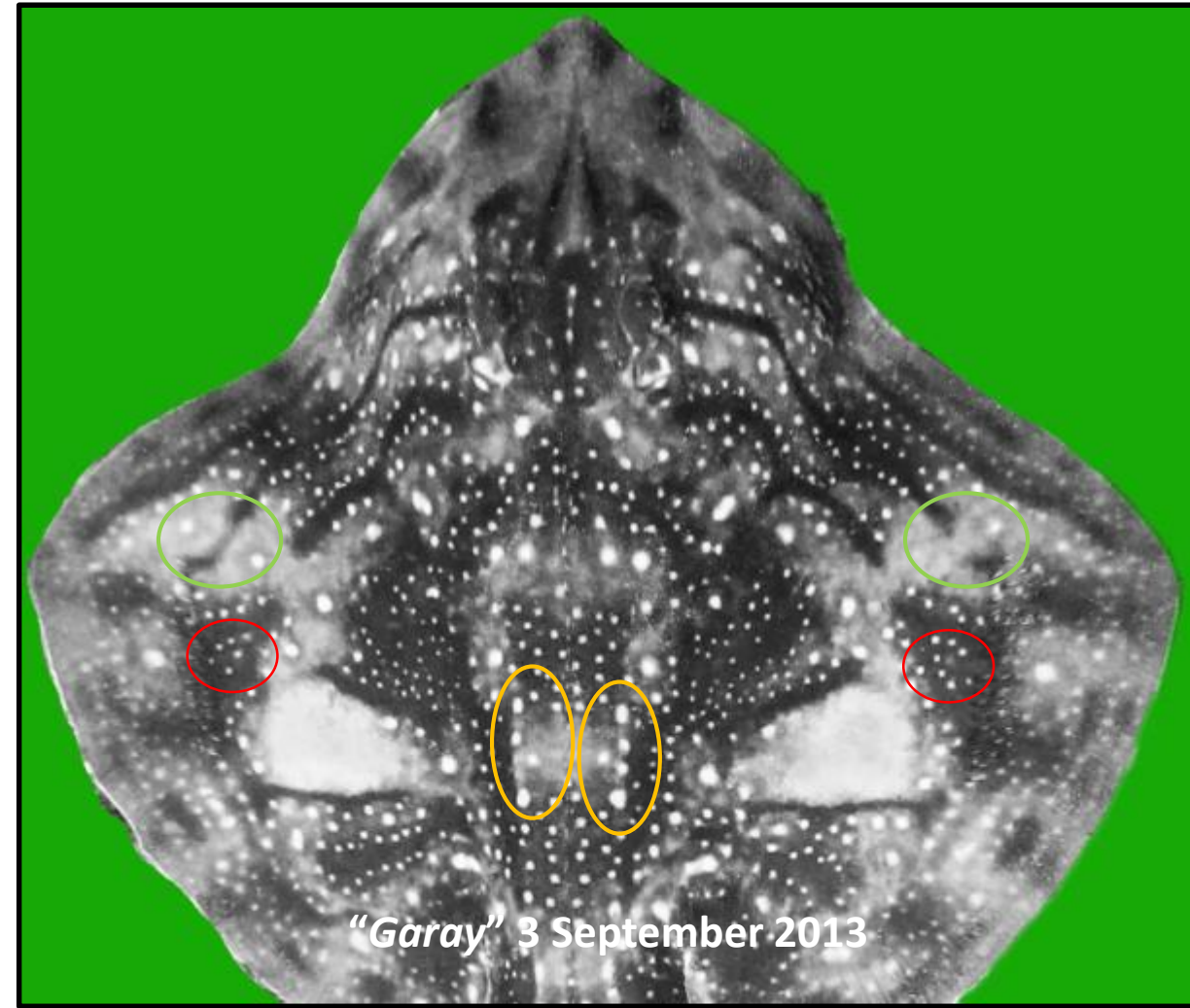
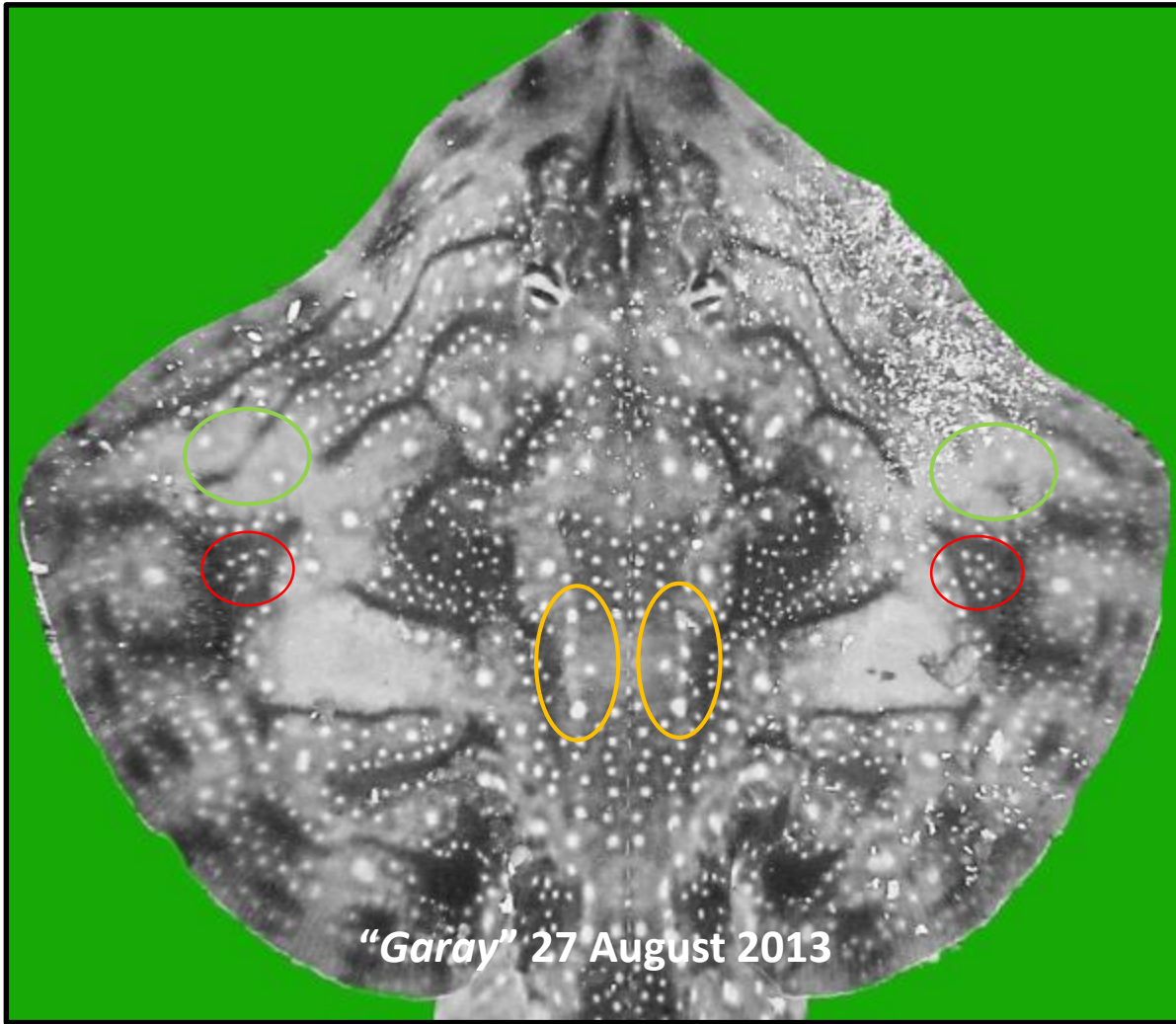
Ray Identification



Computer software is used to identify the most likely matching photographs ...

Wild-ID 1.0 is free software developed by Dartmouth College that also includes free software from other sources. Employs the SIFT operator (Scale Invariant Feature Transform; Lowe 2004) freely available for academic or personal purposes.





*... but finally we compare differences, in both photographs, between left and right sides of the fish.
Rays are not truly symmetrical*

An aerial photograph of a coastline in Dorset, England. The image shows a steep, rocky cliff face on the right side, with a green grassy top. The sea is a deep blue, and the shoreline is rocky and uneven. The text "Our initial interest started in 2012 at one specific Dorset location" is overlaid on the bottom left of the image.

Our initial interest started in 2012
at one specific Dorset location

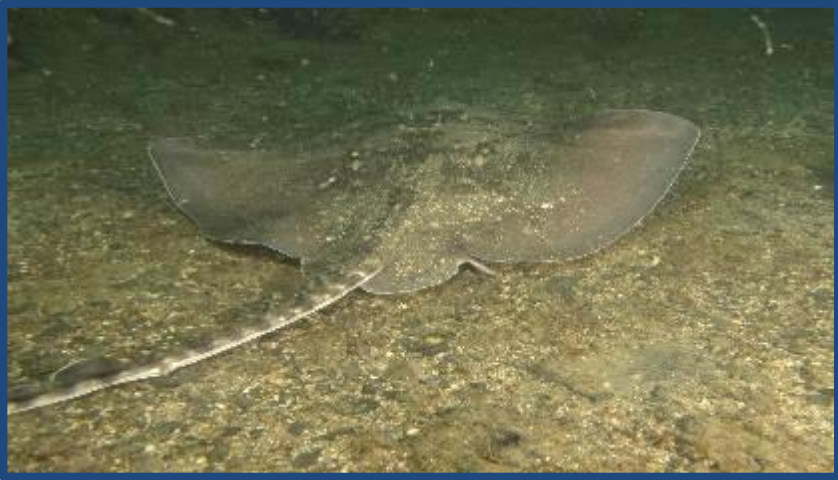
© Matt Doggett
www.mattdoggett.co.uk

Most UK divers report seeing one or two rays a year. On this site, about the size of a football field, we had 201 ray sightings between 2012 and 2016.



To October 2017 on this site:

351 Ray Sightings
311 Undulate sightings
248 Undulates with ID photos
179 individuals
69 repeat sightings



7 thornback

3 where
species not
recorded

1 small-eyed



29 spotted



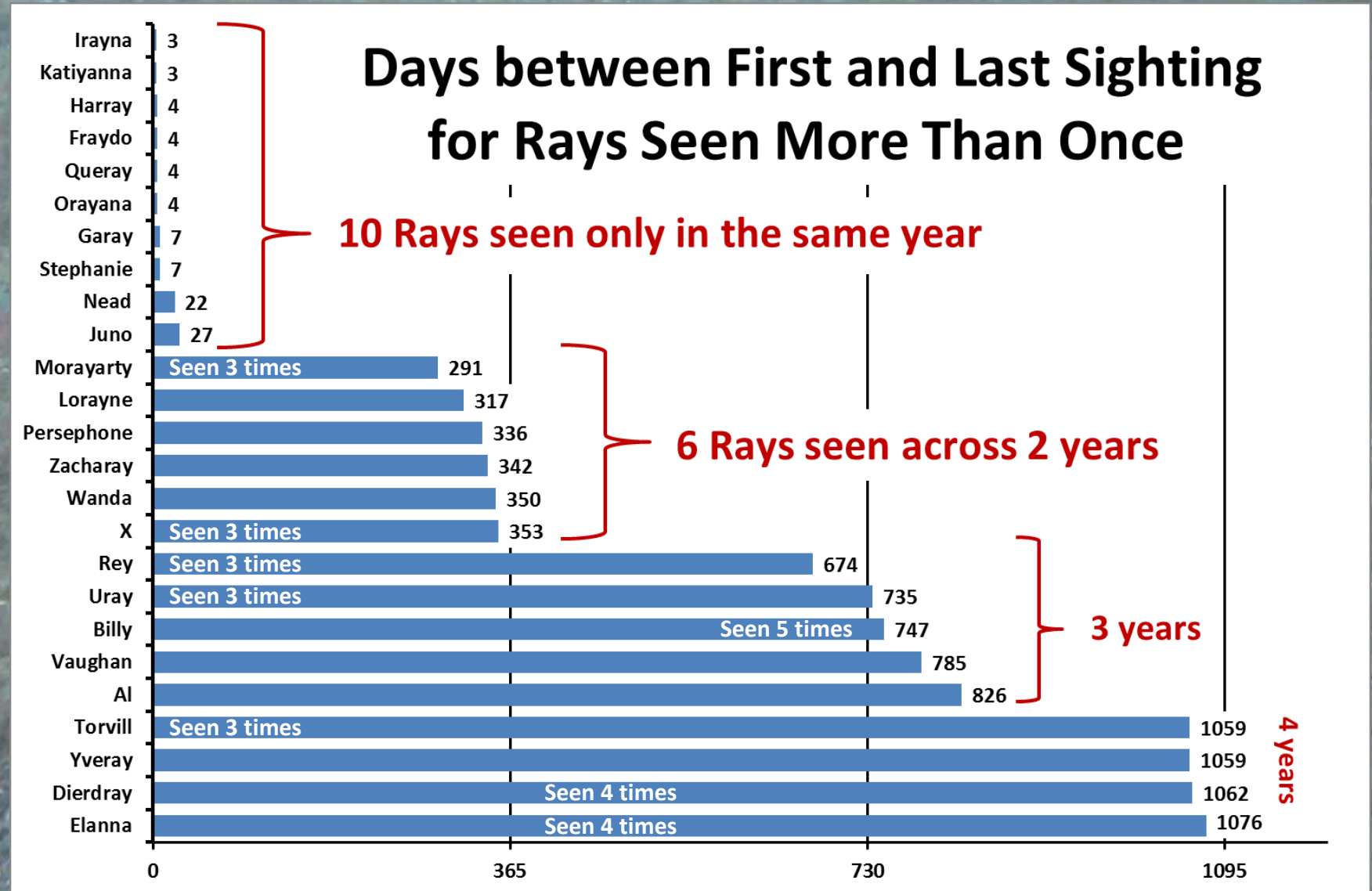
248
with
photographs

311 undulates

179
identified
individuals

Repeat Sightings

- Data to end 2016 only
- Some rays are seen just a few days apart however
- Rays are often seen again after a gap of months or years



Conclusions

A methodology has been developed to identify individual undulate rays from photographs of the pattern on their upper surface.

The frequency of repeat sightings in the data, approximately 1 in 5, suggests that the overall ray population visiting the site is not large.

The scarcity of single individuals being seen many times suggests the rays may visit the area on a periodic basis.

Presented at Annual European Elasmobranch Association Conference, October 2016

Enhancing site fidelity information by identification of individual *Raja undulata*

Sheilah and Martin Openshaw
Stardis.co.uk Hampshire, England

Introduction

Individual undulate rays, *Raja undulata* can be uniquely identified from photographs of their dorsal surface which exhibits a unique pattern.



Divers have monitored undulate and other rays on a particular Dorset site and shown that individuals return to the same site over prolonged periods and over successive years.

Site Results

- 163 ray encounters with divers in 3 years
 - 135 undulate rays,
 - 20 spotted rays,
 - 5 thornback rays,
 - 3 species not recorded
- Undulate rays - 60% female and 39% male.
- 121 identifiable with photographs
 - 25 repeat encounters, i.e. the individual ray had been seen on the site before.
- 96 individual different undulate rays
- 19 of the individuals (20%) seen on more than one day.
- 8 individuals have been seen on more than one year.
- "Billy" - seen 5 times over three years.

Conclusions

- R. undulata* have a unique pattern on their dorsal surface that can be used to individually identify the ray.
- Using this technique rays have been recorded repeatedly returning to one particular Dorset site. Site fidelity for individual fish has been demonstrated to within approximately 30-metres over successive years.
- Similar sites are likely to exist however the importance of this or similar sites to ray populations remains unknown.



Methodology

Rays are found resting on the seabed and most can, with care, be approached and photographed for identification. A good quality image is not essential, but the full width of the ray in the photograph allows a better analysis of the individual pattern. Prior to analysis the images are processed to be the same size, colour, format and orientation. Pattern matching of the individual rays is assisted by a software application, Wild-ID, freely available as a download from the website of Dartmouth College, Hanover, U.S. Individual identification of each ray is based on its markings, which are asymmetrical on the wings, body and tail.

Each ray is individually coded and the data stored in a custom database to allow easy analysis of repeat sightings.



Divers visit the site on relatively few occasions, however, the occurrence of repeat sightings has increased as the project continued. Repeat sightings are approximately 1 in 5 and may be days or years apart. The data suggest that the rays represent a relatively small population that visit the same area/site on a regular basis.

Where possible photographic scales are positioned alongside the ray to provide additional dimensional data relating to their size and maturity.

A good quality image is not essential, but the full



References

The IUCN Red List of Threatened Species. Version 2014.3. Downloaded on 15 March 2015.
An overview of the biology and status of undulate ray *Raja undulata* in the north-west Atlantic Ocean. Ellis, McCully & Brown. Journal of Fish Biology (2012) 80, 1057-1074.
Length at maturity, conversion factors, movement patterns and population genetic structure of undulate ray (*Raja undulata*) along the French Atlantic and English Channel coasts: preliminary results. E. Stephan et al.

Rays and skates: a revision of the European species. Robert Selby Clark. HMSO publication 1955.

Further Information

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Winners of 2016 Duke of Edinburgh Prize for underwater research for work with The Black Beam Project

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Dartmouth College, Hanover, U.S. for the availability of the Wild-ID software application.
Nick Forward, fisherman.





January 2017 Project & Web Page Launch

"Blanc"

Seen in Sept 2013, May and August 2017

Rays were swimming in our seas when dinosaurs walked along British shores.



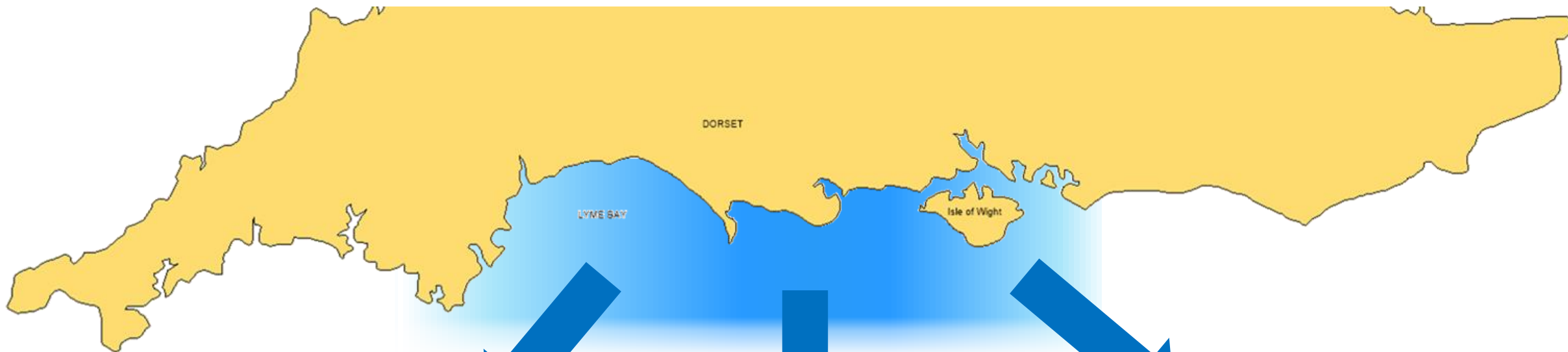
The undulate ray can still be found along the Jurassic Coast, but little is known about their habits and movements in the wild. This project is to explore the lifestyle of the undulate ray.

... but we need your help.



"Dierdray"

Seen in 2013 and 2016



Anglers



Divers



Fishermen





Take Part

If you are an angler who catches an undulate ray or a diver who sees an undulate ray lying on the seabed, capture the moment, give yourself a memory with a photograph and then send it to Billy at: -

billy@undulateray.uk

We only ask people to send an email, with a photo, including when and where it was seen.





- 23,000+ visitors to the website (62,500+ hits)
- 218 Facebook members
- 83 people contributing images
- 669 total ray sightings (491 individual rays)





Project Status, 7th October 2017: 474 undulate rays recorded with 58 seen on more than one day.

	All Data	Original Site	Rest of Data
Undulate rays seen	637	305	332
Identified individuals	474	177	297
Number seen > 1	58 (12%)	45 (25%)	13 (4%)
Returns (% of individuals)	83 (18%)	69 (39%)	34 (11%)

DNA sampling for genetic analysis



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Genetic Analysis

Part of a larger project with **Samantha Hook** from the University of Manchester to determine the genetic health of undulate ray populations and their ability for adaptation.

The ***undulate ray project*** provides a unique opportunity to obtain genetic materials in a harmless and sustainable way from a live ray population.

The analysis will verify the identification process and help us understand the family relationships of the rays we photograph and observe.

A sampling methodology has been established and the ***Undulate Ray Project*** has successfully obtained DNA from 48 individual rays, in some cases, more than once.

Some rays swim away but others appear to enjoy having their back swabbed and stay around for more.



Thank-you

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