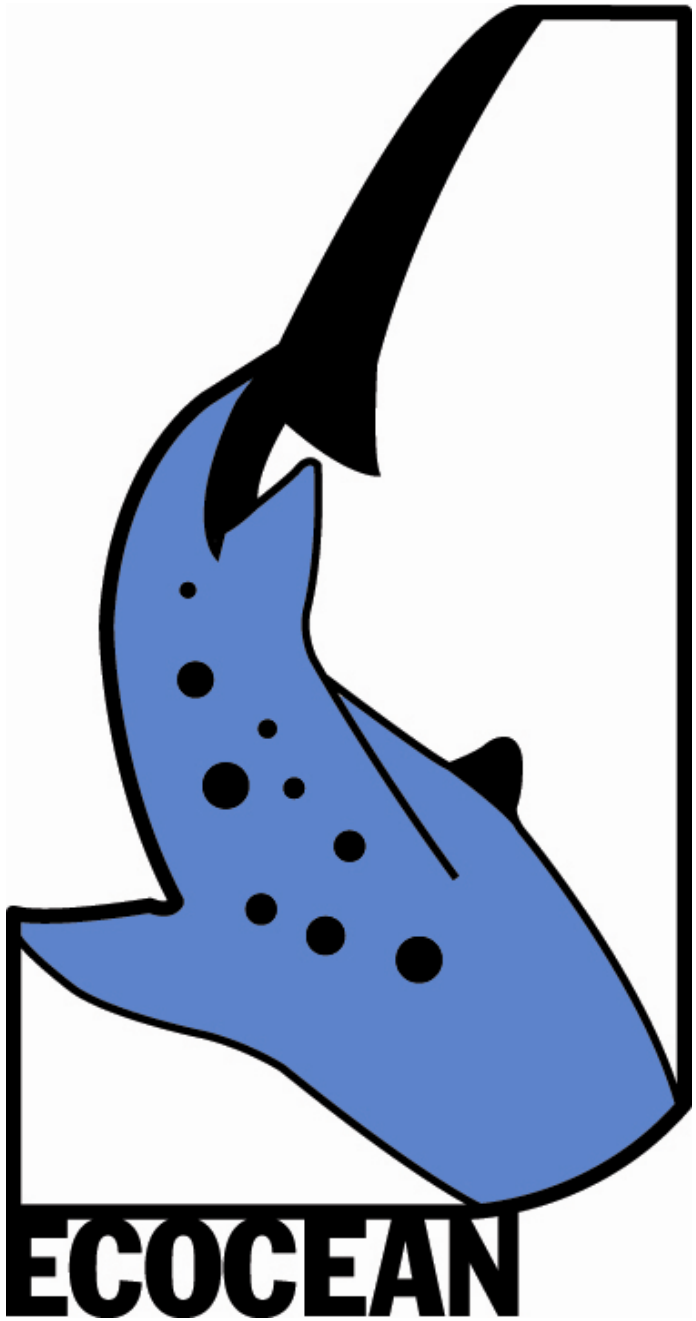

ECOCEAN

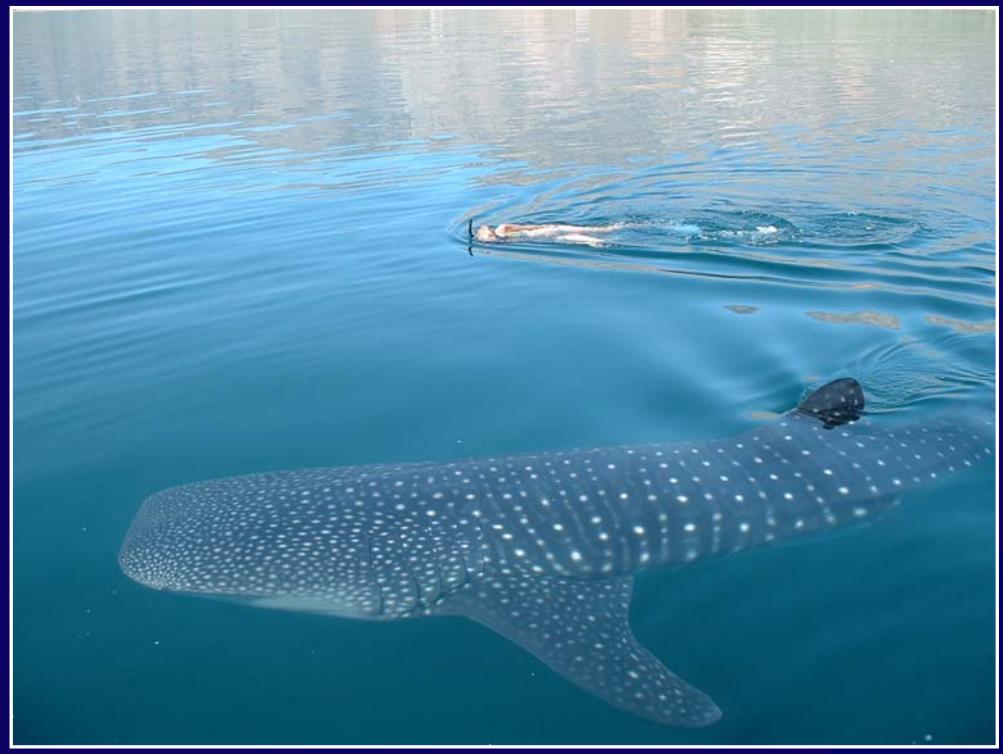
Collaborative monitoring of whale sharks on a global scale:

the ECOCEAN approach

Murdoch UNIVERSITY

ECOCEAN research, education & conservation

ECOCEAN is a not-for-profit, non-government organisation committed to the protection of the world's biggest fish, the whale shark.



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ECOCEAN – KEY OBJECTIVES

- Ongoing expansion and development of the ECOCEAN Whale Shark Photo – Id Library
- Actively direct additional global photo - id research effort with socio-economic benefits for developing countries
- Promote research, development and deployment of all other relevant technologies
- Facilitating cooperation between stakeholders, including data sharing
- A trusted resource for researchers, reviewers and management agencies
- A clearing house for information relevant to the species
- Advocacy for whale shark protection locally and globally, and through promotion of ‘best practice’ management

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The ECOCEAN photo-identification library at

www.whaleshark.org

was developed to enhance our understanding of this animal and its needs for survival.

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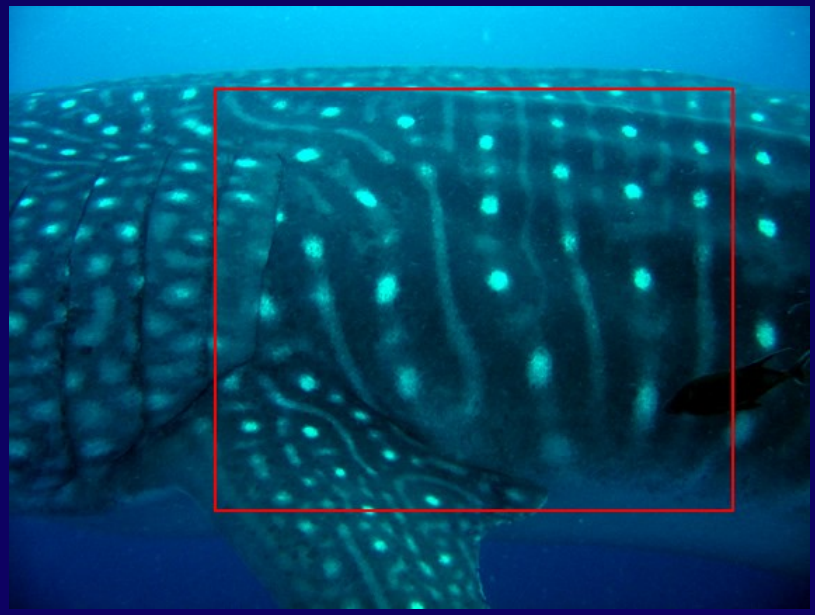
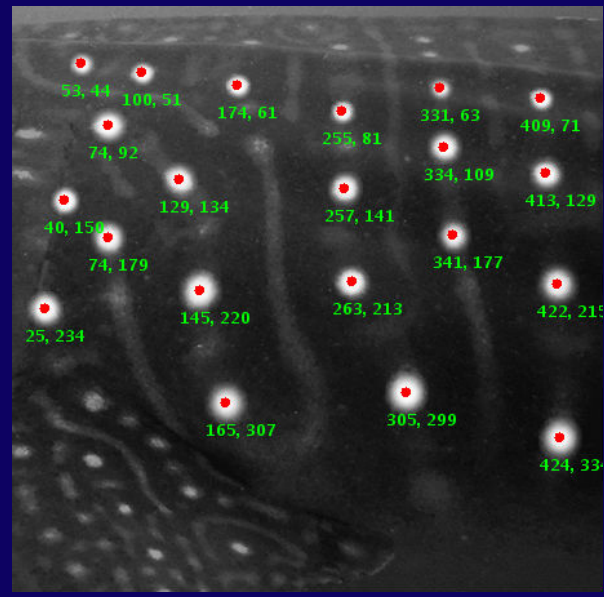
Strategy:
Natural tagging - photo-identification





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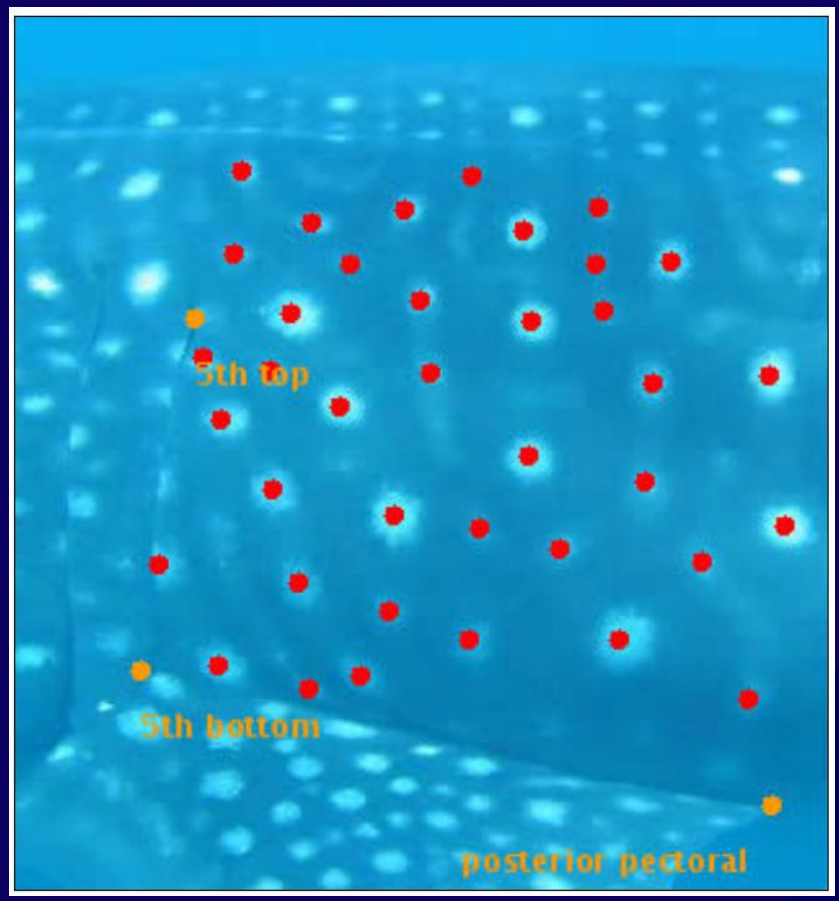
Whale shark photographs are submitted directly by researchers and / or members of the public to the www.whaleshark.org website and powerful algorithms analyse images for cross-matches.



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In the beginning ….

• Focus was on Ningaloo

• the ECOCEAN Library was initiated between1995-97 via a comprehensive photo-id study (MPhil.) supported by various stakeholders

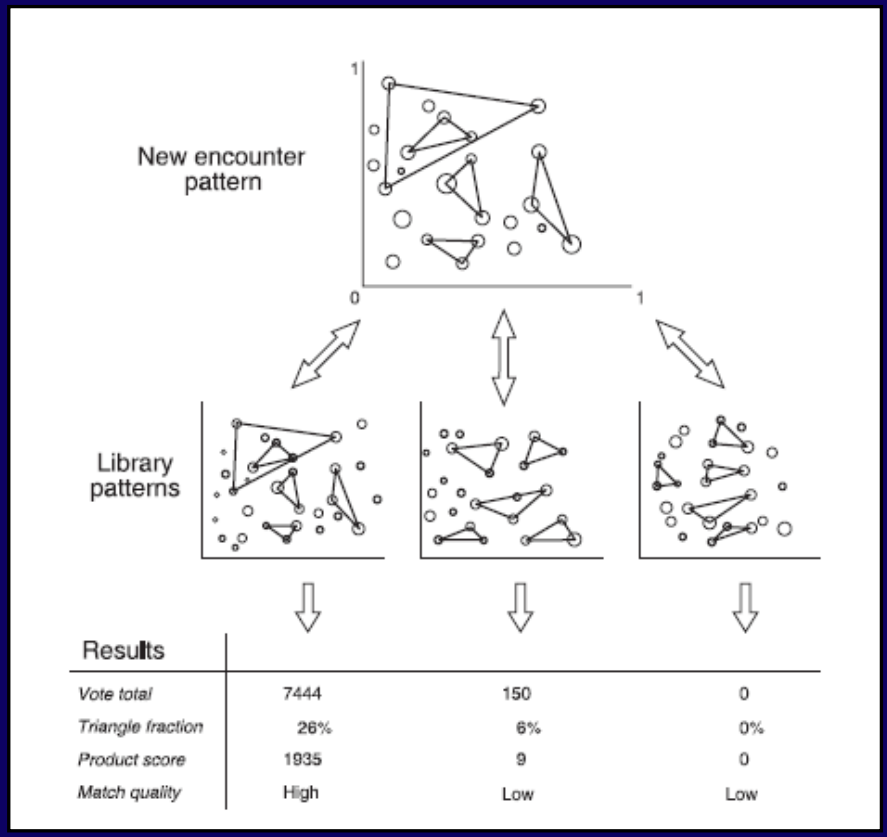
• spot-pattern recognition
- Jason Holmberg joined in 2002
- Zaven Arzoumanian joined in 2003

• substantial additional input to the ECOCEAN Library has been provided by industry personnel and other researchers both at Ningaloo and throughout the world

The Algorithms

- NB. The primary algorithm employed within the ECOCEAN Library is the Groth algorithm (developed and used by NASA).
- A second algorithm (I3S) has been included in the Library and is used to scan each appropriately oriented whale shark image.
- We do however, gain better results from the Groth algorithm.

How the system works.....



Results			
Vote total	7444	150	0
Triangle fraction	26%	6%	0%
Product score	1935	9	0
Match quality	High	Low	Low

Spot Pattern Scans

The following encounter(s) received the highest match values against a left-side scan of encounter# 2562007115335.

Saved scan data may be old and invalid. Check the date below and run a fresh scan for the latest results.

Date of scan: Sat Jun 30 17:14:22 EDT 2007

Standard Scan

For this scan, the following variables were used:

- epsilon (0.01)
- R (8)
- Sizelim (0.85)
- C (0.99)
- Max. Triangle Rotation (10)

Shark	Encounter	Fraction Matched Triangles	Match Score	logM std. dev.	Confidence
A-093	1712200435025	0.323	157.48	0.05115	High
A-093	299200411825	0.319	109.21	0.01794	High
A-093	4820041574	0.165	41.169	0.05558	Moderate
A-093	11102006101610	0.229	37.368	0.05216	Moderate
A-093	592005125819	0.138	29.004	0.06407	Moderate
A-093	17112005145336	0.105	16.786	0.03861	Moderate
A-093	128200612585	0.126	11.235	0.16704	Moderate
A-340	1382006235010	0.067	6.9083	0.30915	Low
A-172	6320050458	0.065	6.5079	0.2598	Low
MZ-007	30520058225	0.061	5.7430	0.28903	Low
CR-007	3012007205125	0.061	5.7430	0.12805	Low

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To date the *ECOCEAN Whale Shark Photo-identification Library* has logged:

5900 whale shark encounters

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from 39 countries

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identifying 1400 individual sharks

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By tracking individual animals across time and space, data resolves into a picture of whale shark movements and becomes a primary tool for research and population modelling efforts.

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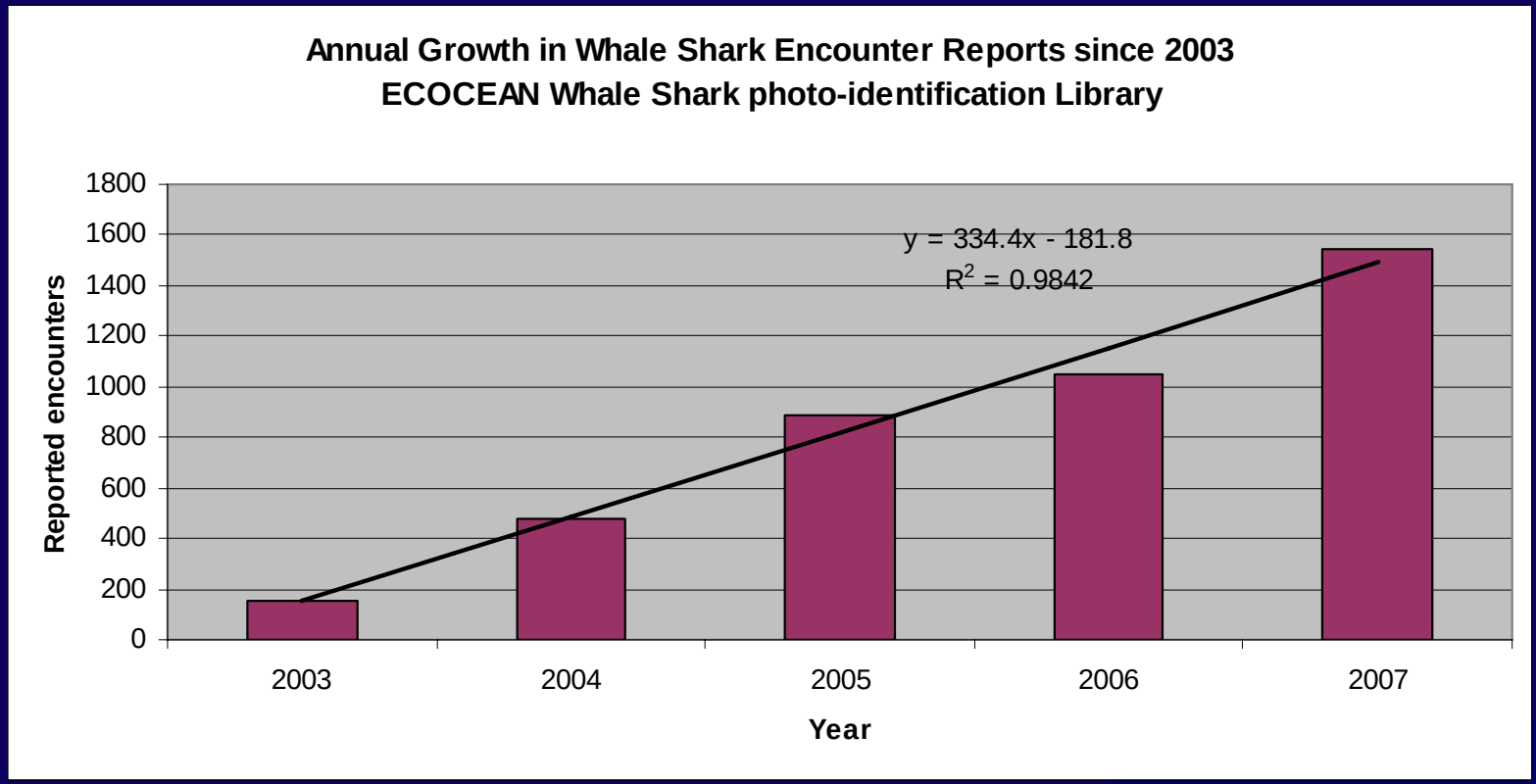
Uptake of the Library since 2003



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Global program

As an example: the number of identified sharks within the Library include:

495 from Ningaloo (Australia)
310 from Mozambique
195 from the Philippines
70 from the Seychelles
20 from Belize
60 from the Maldives
65 from Honduras

etc.

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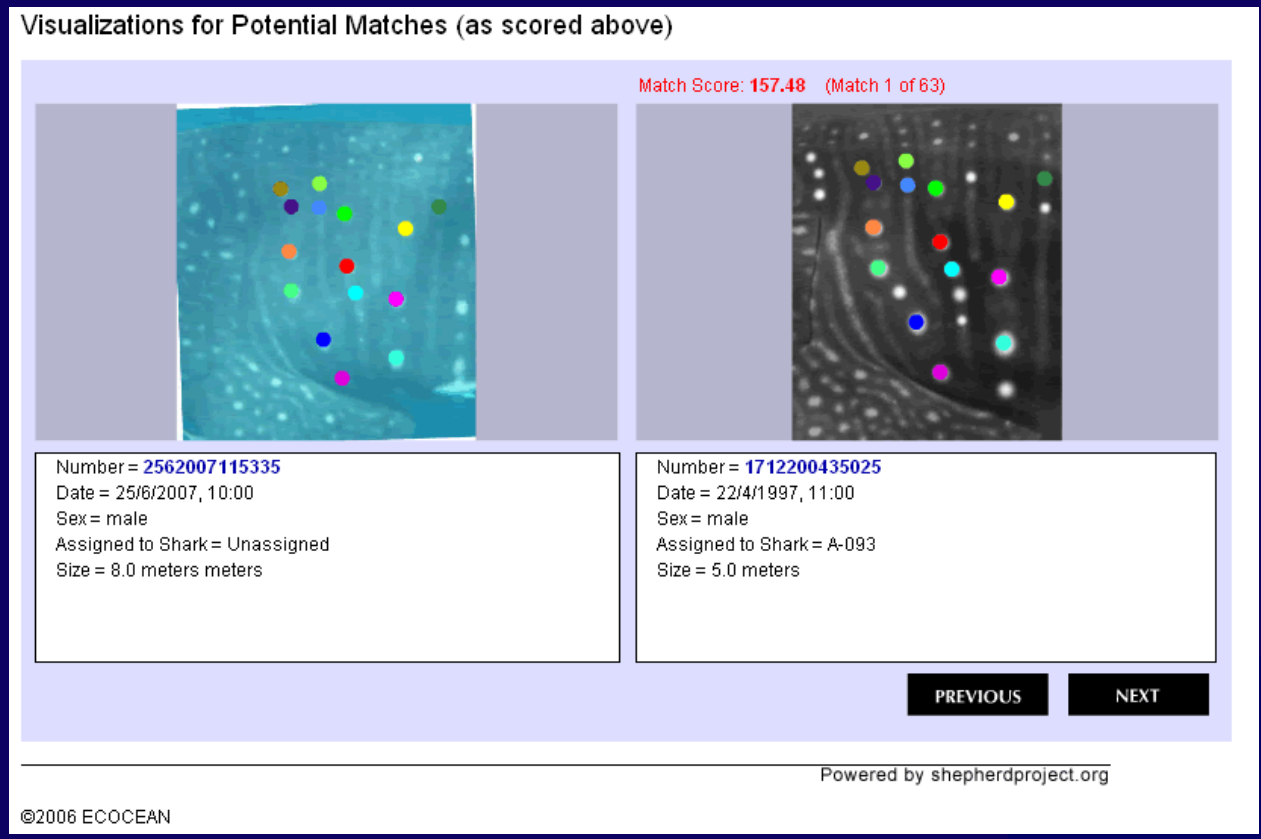
ECOCEAN developed an award-winning suite of software tools to enable analysis and discussion within scientific, conservation and management communities.



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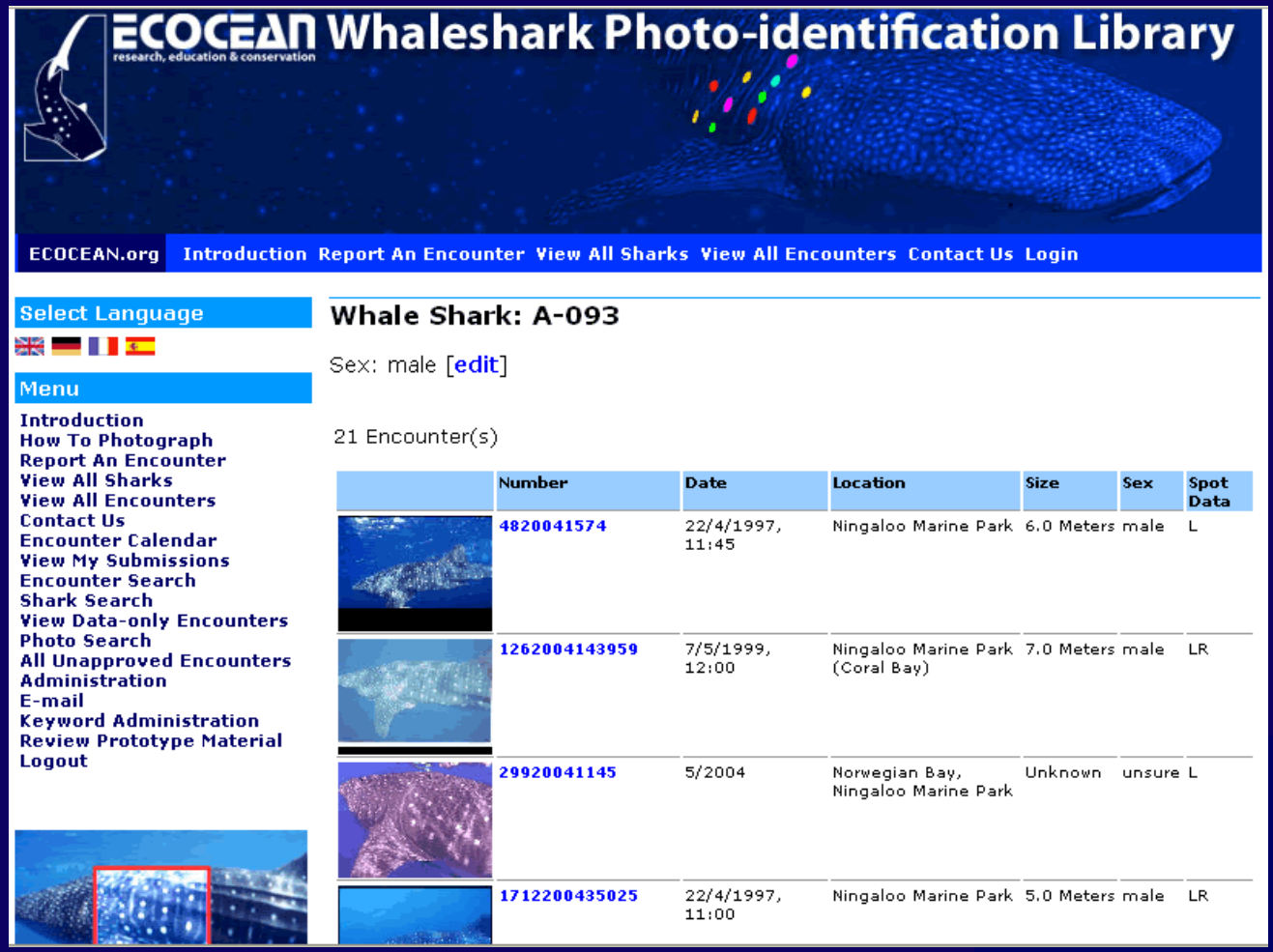
All encounters are recorded in a managed database which can then be queried by researchers.



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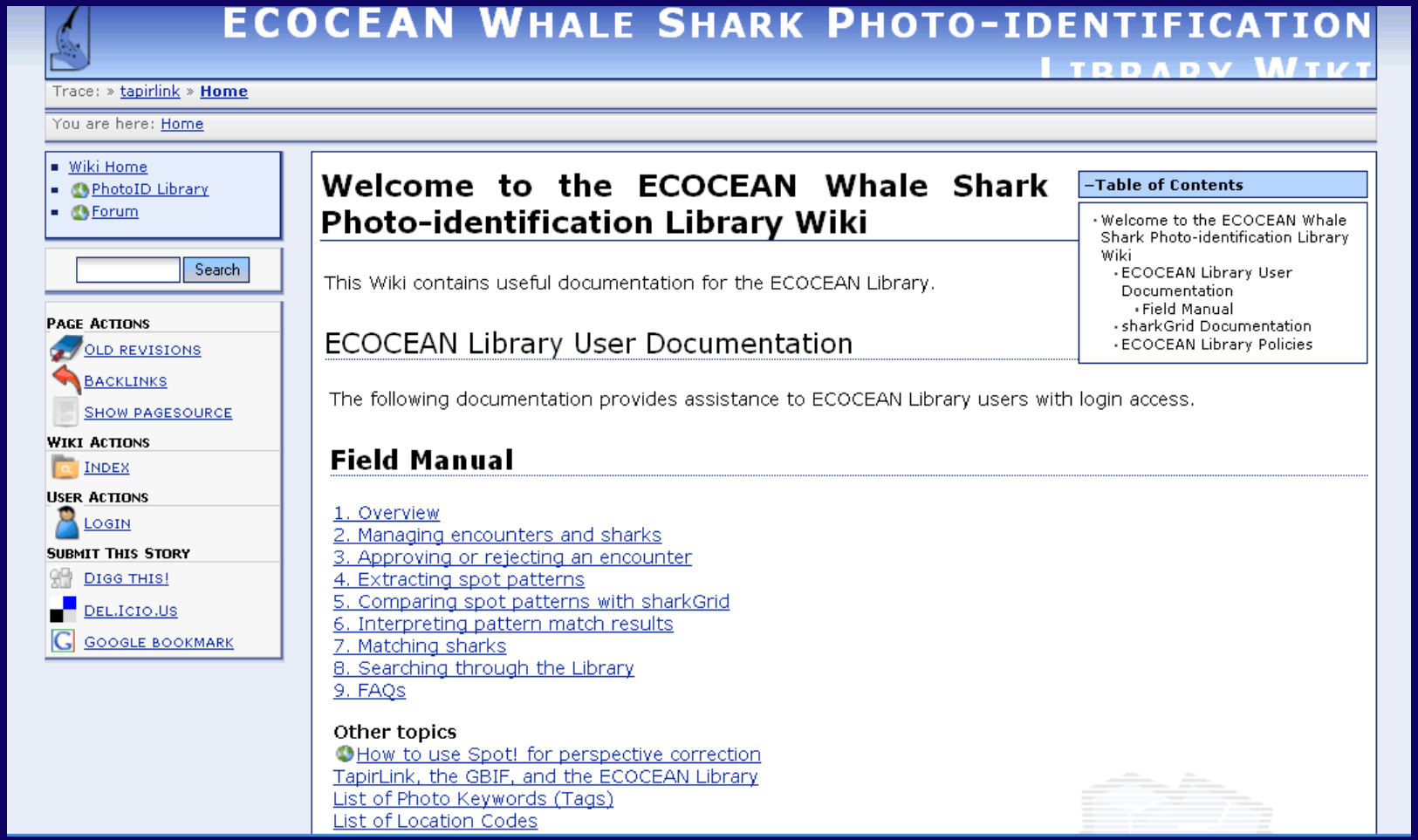
Access to the Library

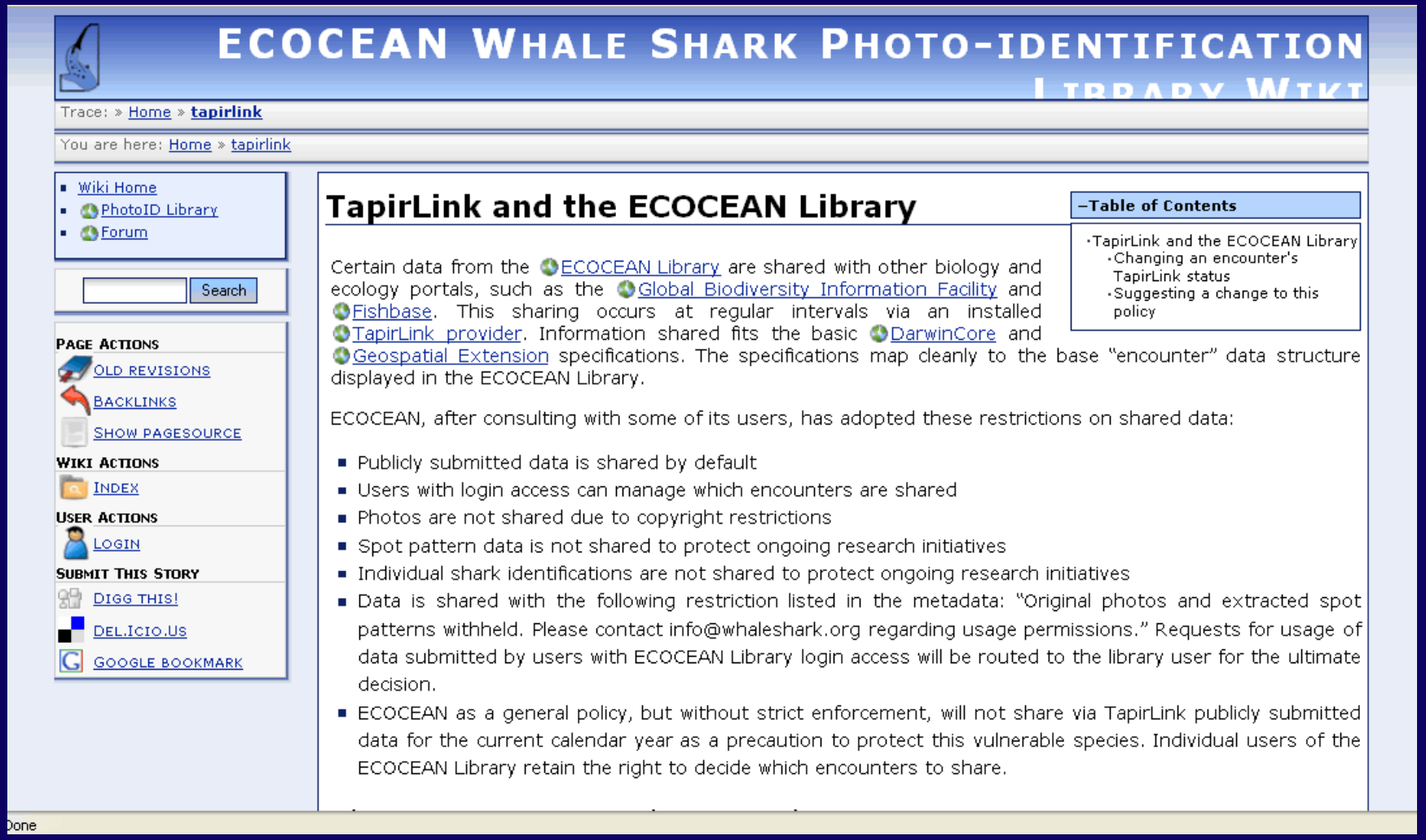


Access to the Library

The Management Committee of ECOCEAN looks at several criteria when reviewing a request for access, including:

- Your ability and willingness to contribute new whale shark data
- Your ability and willingness to follow the analytical techniques used in the ECOCEAN Library
- Your ability and willingness to develop new techniques for whale shark research
- Your ability and willingness to develop new science for other fields using whale shark data
- Your ability and willingness to use whale shark data collaboratively
- ECOCEAN's available resources to properly support you

Data sharing



Other possible inclusions
(for individual sharks)

- Genetic profiles
- Satellite tracks
- Behavioral profiles
- etc.

- Nb. This has the opportunity to be a global clearing house for many forms of data on whale sharks

sharkGrid.org

sharkGrid

Welcome to the sharkGrid! The sharkGrid allows you to donate spare cycles of your computer to whale shark research. Specifically, the processing power of your computer can be "borrowed" for resource intensive tasks, such pattern recognition or data mining. sharkGrid uses "**volunteer computing**" (a.k.a "global **grid computing**") to distribute intensive tasks between multiple computers to allow them to complete much more quickly.

How to Join sharkGrid

Welcome to the sharkGrid! The sharkGrid allows you to donate spare cycles of your computer to whale shark research. Specifically, the processing power of your computer can be "borrowed" for resource intensive tasks, such pattern recognition or data mining. sharkGrid uses "global volunteer computing" to distribute intensive tasks between multiple computers to allow them to complete much more quickly.

There are a few quick things you should know before participating in sharkGrid.

1. Once running, the sharkGrid client must stay open to allow your computer to aid in whale shark spot pattern processing. If for any reason you want to leave the grid, close the client. If you restart your computer, you must restart sharkGrid to participate.

2. Your Internet connection must remain open to participate in sharkGrid. sharkGrid obtains all patterns to compare from the World Wide Web.

3. Your computer must have a Java Runtime Environment (JRE) 5 or higher installed. You can download a JRE from the Sun Microsystems Java web site. The JRE is different from the Java Virtual Machine (JVM) that runs in your browser. The JRE allows Java applications to run as programs on your desktop.

4. Please disable any power saving features enabled on your computer. For example, many PCs will enter a suspended state (a.k.a. "System standby") after a period of time with no user interaction. Other power saving schemes stop the hard drive(s), which will also interfere with the sharkGrid client.

5. sharkGrid participation is subject to the ECOCEAN Library Visitor Agreement. By visiting this web site and joining sharkGrid, you are agreeing to the terms and conditions therein.

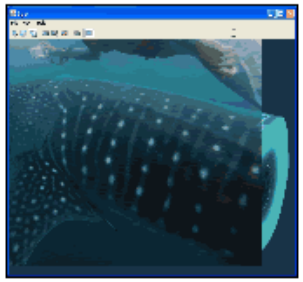
6. sharkGrid can run in the background while you perform other tasks on your computer. However, sharkGrid is used for intensive computation, and other applications running on your computer simultaneously with sharkGrid may slow down.

7. sharkGrid requires significant computing power. We recommend you only run sharkGrid on computers with 1 gigabyte (GB) of RAM or more.

Downloading the sharkGrid client

SPOT!

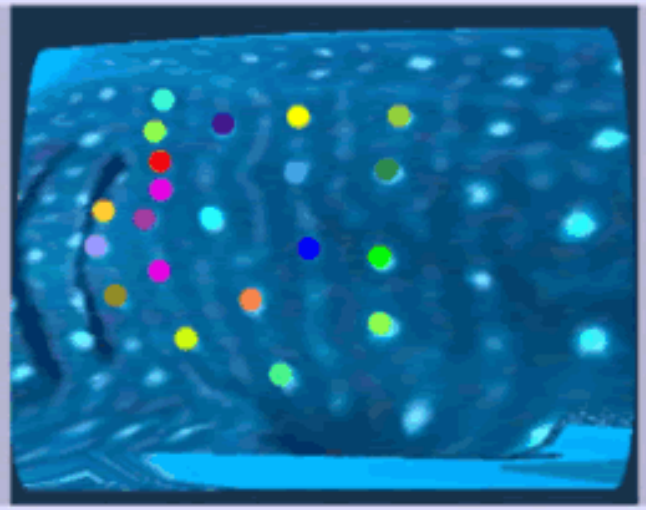
Spot! Online Help

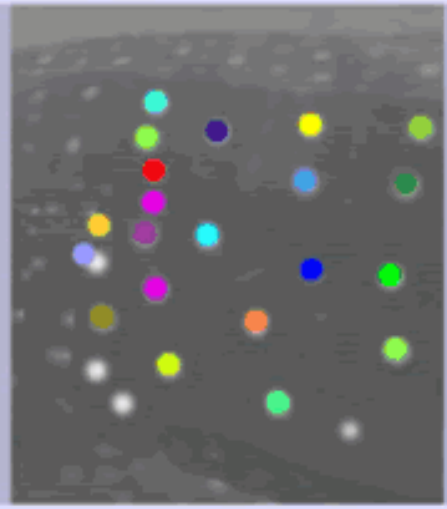


The spot pattern recognition algorithms used in whale shark mark-recapture (Modified Groth and I3S) assume a flat, two-dimensional surface when analyzing the relationships between spots. While each algorithm has some tolerance for skew in an image, both quickly degrade in their ability to match identical patterns as the angles between those patterns increases.

Spot! allows you to map a skewed 2D image to a 3D whale shark model and obtain a properly-oriented left- or right-side pattern for use with the Modified Groth and I3S algorithms.This perspective correction has been used in the ECOCEAN Library to match images taken from very extreme angles to previously tagged whale sharks. For example, Spot! was used to make this match for shark M-025 in the ECOCEAN Library.

Match Score: **556.90** (Match 1 of 33)





Number = **182200825816**
Date = 9/2/2008, 11:00
Sex = Unknown
Assigned to Shark = Unassigned
Size = 5.0 meters meters

Number = **289200675324**
Date = 11/5/2006, 14:45
Sex = male
Assigned to Shark = M-025
Size = 6.0 meters

PREVIOUS NEXT

Let’s centralise data….

- With increased uptake we continue to develop improved functionality (something ECOCEAN would like to explore further with the establishment of a Library ‘stakeholder council’)

- What other data-sets could be / should be included within this ECOCEAN database?

OPEN FOR DISCUSSION

NB. ECOCEAN (primarily a volunteer organisation) has developed a ‘User Policy’ (see wiki) and links with the following initiatives (e.g. GBIF, FishBase etc.)

Collaborations

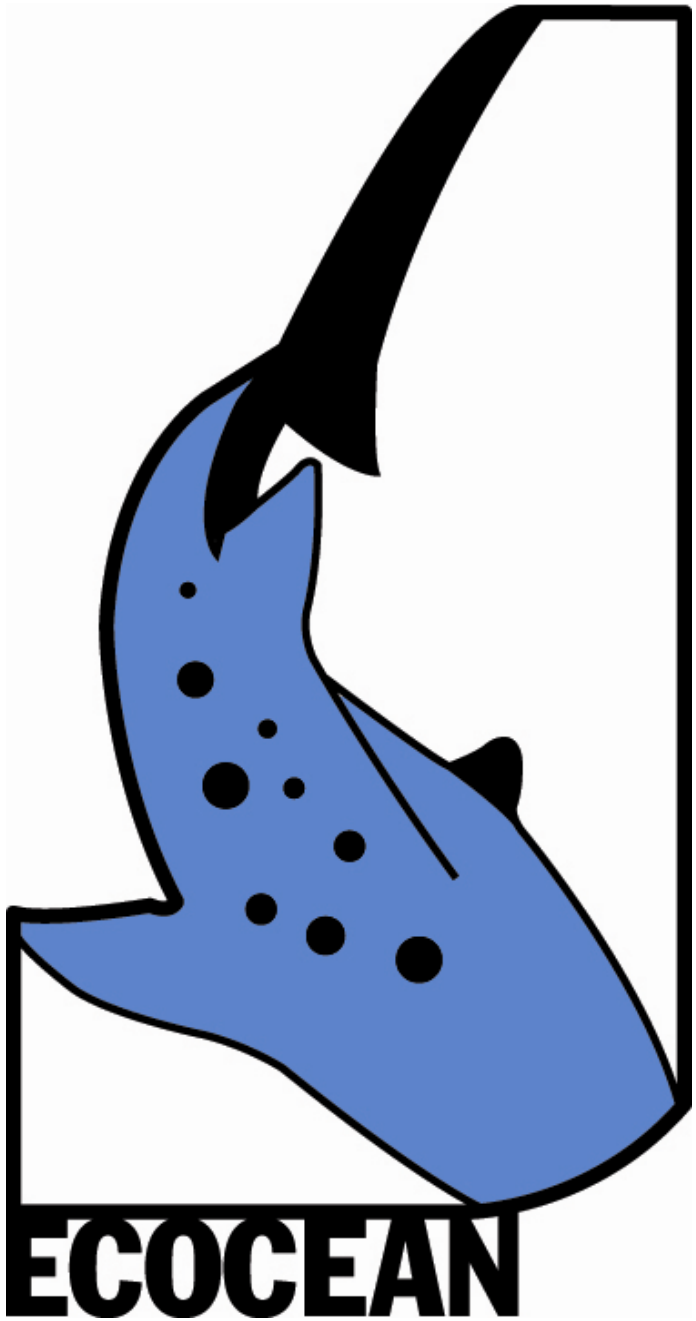
Whale shark ecotourists worldwide
Whale shark researchers worldwide
Whale shark industry worldwide

Murdoch University
Carl Schwarz (Simon Frazer University)
British Ecological Society
Project Aware
National Geographic Society
WA Department of Environment and Conservation
Wildlife Trust of India
WWF (Denmark, Philippines)

The ECOCEAN Library program has continued to receive considerable media exposure

…. Which has enabled the program to record significant growth….

Major sponsors include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