The Eastern Tropical Pacific Ocean Seascape (2004)

Main threats:
- IUU
- Overfishing
- El Niño Events
- Coastal development

Also Coiba & Las Perlas (Panama)
Gorgona (Colombia)
Isla de la Plata, Machalilla (Ecuador)
Connectivity

Populations which move between sites on an oceanic level
  - Feeding grounds to breeding grounds
  - Inter-island movement
  - Ontogenetic movements
  - Shifting resource distribution
  - Fragmented habitat (island hotspots)

Larval drift
  - Little known in the region

Human Use
  - Fishing vs tourism vs conservation
Early Observations

Rapid changes in the make-up of the pelagic assemblage over a two week period

Jacks, snappers, sharks seemed to be present/absent at the same time

Presence coincided with warm water and low plankton concentrations

Suggested use of hammerhead sharks as umbrella species
As well as potential umbrella species:

Apex predators, drive natural selection processes
Slow growth, late onset of sexual maturity, low fecundity – intrinsic characteristics make sharks vulnerable.

Recent studies have shown declines in shark populations in almost every single population studied

Ecological effects of top predator decline hard to predict but can be wide ranging

Increase in demand for shark fins and controversy surrounding practice of shark finning.

... and now a multi-million $$$$ dive industry
**Marine Corridor and Hammerheads**

Known aggregations of sharks around oceanic World Heritage Sites (hotspots)

Known nursery grounds along coast of Panama, Costa Rica

1. Are HH resident at hotspots?
2. Do they move between hotspots?
3. What stimulates a movement between hotspot?
4. Are there defined routes between hotspots (and nursery grounds)?
5. How do they navigate?
Shark Tagging: ultrasonic coded tags

VEMCO V16 coded tags. Emit train of pulses at 69 KHz.

Tags are attached to darts and placed on pole spears. Free divers descend onto sharks and insert tag behind the dorsal fin, at a distance not greater than 50 cm from the shark.

VEMCO VR2 listening stations (and temp logger), deployed on subsurface moorings.
A Regional Array
A Galapagos Array
Residency

Quarterly censuses were conducted by SCUBA divers of the abundance of scalloped hammerhead sharks around coast of Wolf Island. Tags were placed on 40 scalloped hammerhead in August 2006 and 60 individuals in August 2007.
Censuses of Fishes

Scalloped hammerhead shark

Crevelle and green jacks

Steel pompano

Galapagos shark

Bottlenose dolphin

Yellowfin tuna

Snappers

The largest abundances of species were along the eastern coast of the island.
Inter-island movements (local scale)

Of 61 hammerheads tagged at Wolf (2007), only 14 were not detected at a different island.

The remaining 47 undertook 113 interisland movements:
- 1 to Cocos Island
- 8 to Roca Redonda
- 65 to Darwin
- 39 to Wolf (return trips)

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Inter-island movements (local scale)
Inter-island movements (large scale)
Navigation
Whale Sharks
Next steps:

What proportion of the populations are using MPAS and corridor?

How does this impact their population status (MPA design)?

Suite of key species

Use to base zonation scheme

Policy/Management:

Improved coordination between nations (enforcement agreements)
Improved control (VMS, AIS)
Promotion of sustainable development strategies
Raising awareness (e.g. Great Turtle Race)
Standardization of scientific methods and monitoring protocols (Migramar)
Acknowledgements

James Ketchum (Mexico)
Randall Arauz (Costa Rica)
German Soler (Colombia)
Scott Henderson (CI-Seascape)
Mauricio Hoyos (Mexico)
Sandra Bessudo (Colombia)
Hector Guzman (Panama)
Jonathan Green (Ecuador)
Cesar Penaherrera (Ecuador)
Eduardo Espinoza (Ecuador)

Conservation International
Fischer Productions
Galapagos Conservancy
Rapier Foundation
WWF-Ecuador