Drivers of juvenile shark biodiversity and abundance in inshore ecosystems of the GBR

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Coastal Shark Nurseries

- Understanding habitat use is important for conservation/management

- Coastal environments often occupied by the young of multiple species

- Shark nursery definition
  1. Abundant young sharks
  2. Site fidelity
  3. Temporally stable use

- A consistent approach to guide the focus of conservation and management

- What about spatial diversity in young shark habitats?

Yates et al. (2012)
Habitat Diversity

- Most shark nursery research has focused on few species across restricted spatial scales
- Habitat use can vary along environmentally heterogeneous coastal stretches

- Variability in nursery function is presumed but rarely examined or quantified

Froeschke et al. (2010)
Knowledge Gaps

• Broader spatial variations in...
  • shark community structure?
  • habitat use of individual species?
  • nursery function?

• Factors that influence these variations

• Implications of habitat diversity for young sharks

• Occurrence patterns of the youngest sharks & regional variation in parturition (birth)

• Critical information for assessing ecological role, vulnerability, and the efficacy of conservation and management strategies
Project Objectives

• Characterise spatial and temporal patterns in immature shark community structure and the occurrence of individual species

• Explore the ecological drivers of these variations

• Evaluate the relative importance of tropical coastal environments and the potential population-level implications of heterogeneous space use
Data Collection

- Jan 2012–Mar 2014: 8 rounds of fisheries-independent surveys
  - 183 days
  - Baited longline (n = 504; 413 hours)
  - Gill-net (n = 386; 349 hours)

- Collected environmental data

- Sharks identified, measured, sexed, clasper calcification, umbilical scar, tagged & released
Species Diversity

1987 sharks from 22 species
Immature Shark Community Structure

Stress: 0.18

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<th>Rockingham</th>
<th>Bowling Gr.</th>
<th>Upstart</th>
<th>Edgecumbe</th>
<th>Repulse</th>
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Influential environmental variables (gill-net)

1) Water clarity
2) Distance to mangroves
3) Depth
Influential environmental variables (gill-net)

1) Water clarity*Salinity
2) Temperature

Scalloped hammerhead

Salinity (ppt): 31, 35, 36

log(shark abundance) vs. Water clarity (m)

Water Clarity (m)

Kruskal-Wallis rank sum test, df=4, P<0.05

71 10 6 1 15

Spatio-temporal Variations

Neonate
n = 91

YOY
n = 383
Spatial Variation (YOY)

**Blacktip shark**
\[ \chi^2 = 20.1, \text{df} = 4, P < 0.001 \]

**Scalloped hammerhead**
\[ \chi^2 = 34.1, \text{df} = 4, P < 0.001 \]
Temporal Variation (YOY)

Pigeye shark

\[ \chi^2 = 15.8, \; df = 2, \; P < 0.001 \]

Spot-tail shark

\[ \chi^2 = 8.7, \; df = 2, \; P < 0.01 \]
Occurrence Summary

**Scalloped hammerhead**
- Neonates: Oct-Feb
- YOY: year-round
- ↑ occurrence in Rocking and Repulse

**Blacktip**
- Neonates: Oct-Feb
- YOY: year-round

**Pigeye**
- Neonates: Jan-Mar
- YOY: peaked LW, absent EW

**Spot-tail**
- Neonates: Jan-Feb
- YOY: year-round but ↑ in
Synopsis

• Immature shark community structure varied between bays.

• Spatio-temporal occurrence patterns varied between species. Bays were not utilised equally (by some species).

• These differences were linked with spatial heterogeneity in environmental conditions.
Bigger picture

• Risks to sharks in the GBR are managed through a combination of fisheries management & spatial zoning.

• In concert, these two measures appear to be sustaining a healthy population of inshore sharks in the GBRWHA.

• Wide ranging species, such as the scalloped hammerhead do need more attention as some portions of the population may stray into international waters and other jurisdictions.