Dwindling Sea Snakes at Ashmore Reef, Sahul Shelf and Searching for the “Elephant in the Room”.

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Abstract

At least 17 species of sea snakes are recorded from reef crests, lagoons and channels of Ashmore Reef on Australia's Sahul Shelf. Three species of *Aipysurus* are regionally endemic (*A. foliosquama, A. apraefrontalis* and *A. fuscus*) with another two species also endemic to Australia. Surveys up to 1998 indicated a relatively stable population of 6 to 17 snakes per hectare of reef flat at low tide and between 1 and 3 snakes per hectare on the sand flats at high tide, but between 30 to 70 snakes per hectare in the lagoons and seagrass beds at low tide. Mark and recapture studies over three years indicated between 94 and 192 Turtle-headed Sea Snakes (*Emydocephalus annulatus*) frequented a single coral head 30 meters in diameter. Spawning events by Damselfish (*Chromis*) attracted feeding aggregations of Turtle-headed Sea Snakes to the algal-covered coral heads. The reef was prolifically abundant with new individual sea snakes swimming into view each minute.

By 2008 Ashmore Reef supported less than 1 sea snake for every 10 hectares, regardless of habitat, with only three snakes seen in three weeks of intensive survey. Sea snake populations on neighboring reefs, at 30 to 250 nautical miles distant, appeared unaffected. The cause of this decline within the Ashmore Reef National Nature Reserve remains unknown. Possible, but unsubstantiated, causes include: changes in sea level with reef flats altered by erosion and increased sedimentation in lagoons; changes in surface water temperature over the expansive reef flat; changes to rainfall patterns; altered management regimes due to increased surveillance of border security; changes to fishing practices by artisanal Indonesian fishers; increased frequency and closer proximity of seismic surveys and oil and gas well construction by petroleum companies. Sea snakes are considered the marine equivalent of the miner's canary for reef health. Yet the cause of their decline in numbers and species at Ashmore Reef remains the "elephant in the room" until examined afresh.

Locations of Ashmore Reef (1), Hibernia Reef (2), Cartier Island (3), Seringapatam Reef (4), Scott Reef (5)and Browse Island (6)

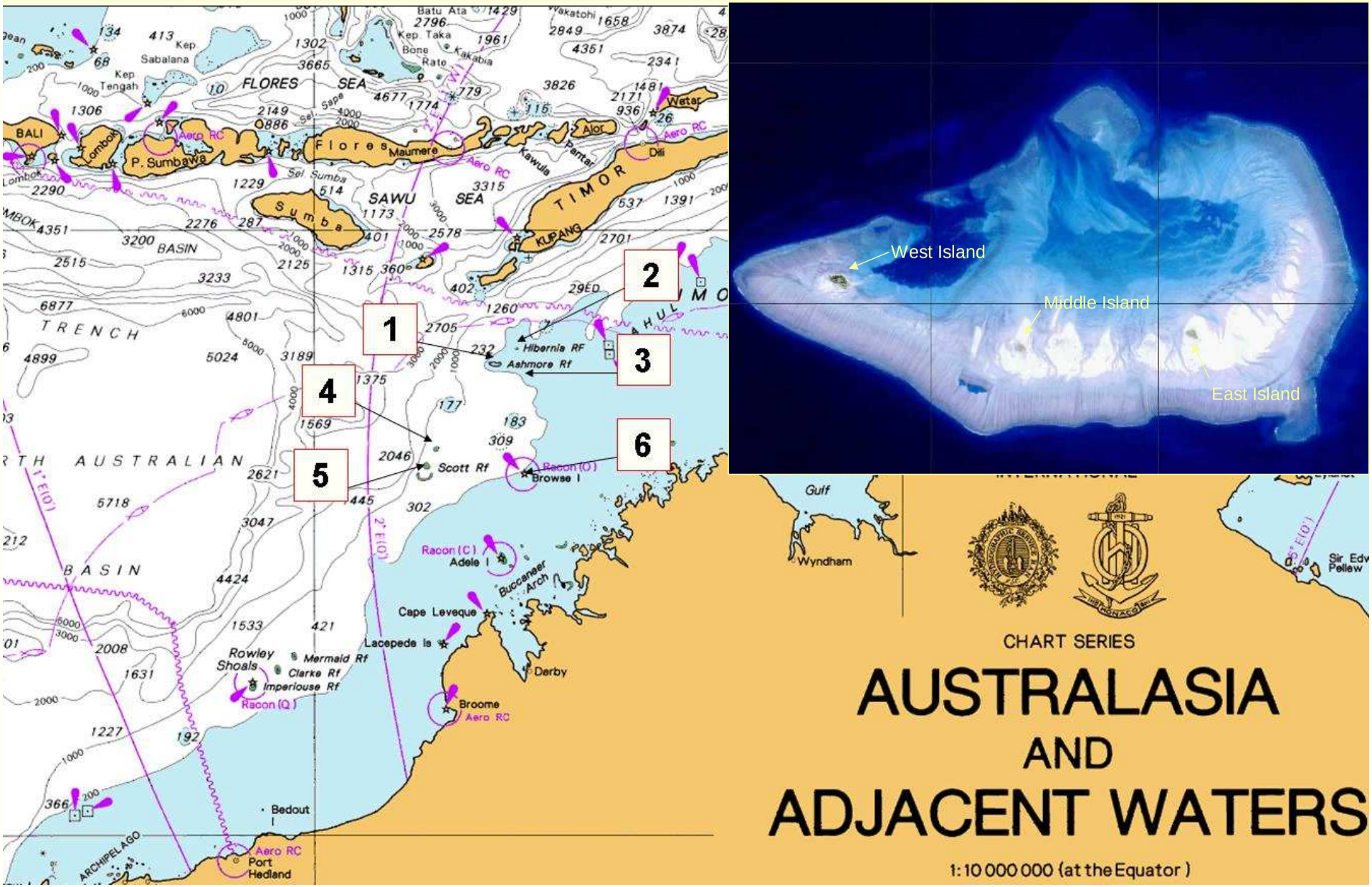

Figure 1 The reefs of the Sahul Shelf with Ashmore Reef (insert)

Table 1 Distribution of the common reef-dwelling sea snake species on the shelf edge reefs of the Sahul Shelf.

Species	Ashmore Reef	Hibernia Reef	Cartier Island	Seringa-patam Reef	Scott Reef
Leaf-scaled Seasnake	yes	yes			
Dusky Seasnake	yes	yes	yes		yes
Short-nosed Seasnake	yes	yes			
Olive Seasnake	yes	yes	yes	yes	yes
Horned Seasnake	yes	yes	yes		yes
Stokes' Seasnake	yes	yes	yes		
Dubois' Seasnake	yes	yes			yes
Turtle-headed Seasnake	yes	yes	yes	yes	yes

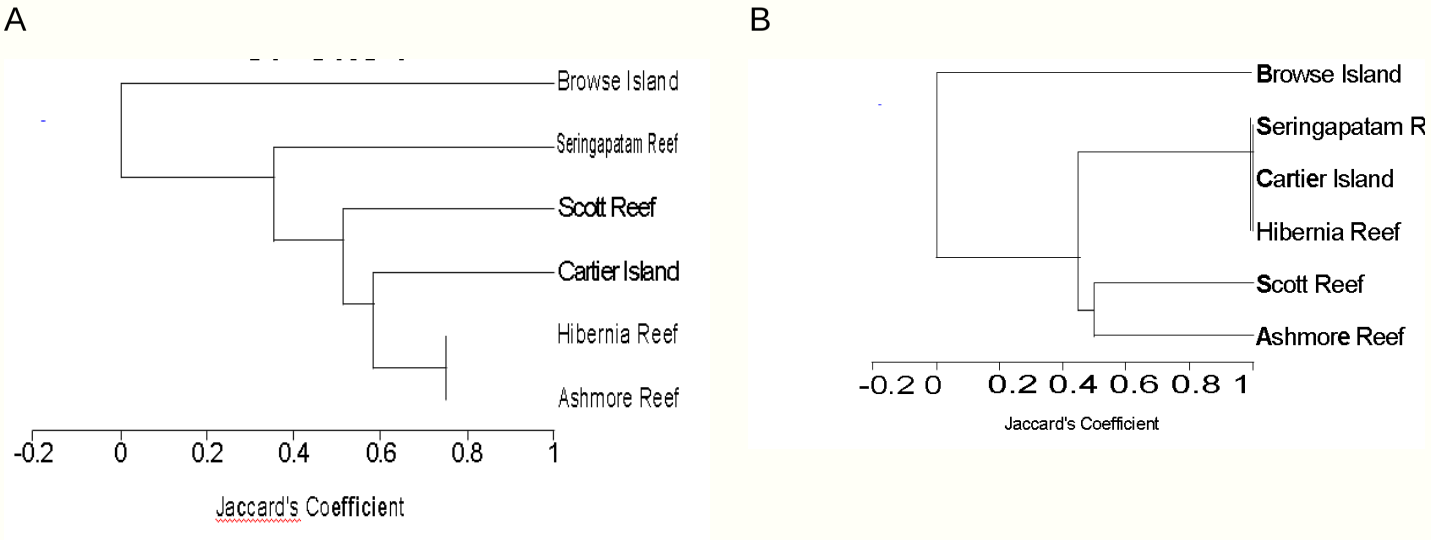

Figure 2. The historical (A) and recent (B) similarity of sea snakes species on the reefs of the Sahul Shelf and Kimberley Coast. The data are Jaccard coefficient of similarity with Unweighted Pair Group Method with Arithmetic Mean (UPGMA) clustering.

Background

Historical accounts of sea snake abundance at Ashmore Reef include:

- Locally abundant – five species – 100+ specimens collected many more available (Smith 1926).
- A total of 420 snakes were collected and numerous others observes over 14 days in January 1973 (Minton and Heatwole 1975).
- Estimates of sea snake abundance (Guinea 1995, Guinea and Whiting 2005)

Methods

- Survey trips conducted almost yearly from 1992 to 2000 and then 2003 to 2008.
- Survey methods included – manta board surveys using snorkel divers, reef walks at low tide, boat surveys at high tide, standard snorkel surveys, capture mark and release of sea snakes in West Island channel, foot surveys on beaches and reef flat at night.

Results

The density of sea snakes in the West Island channel Ashmore Reef decreased with time after 2000 as did those from boat and reef walk surveys. The turtle-headed sea snakes no longer occupied the coral heads within the lagoon.

Date of Survey	Oct-94	Sep-96	Sep-98	Nov-99	May-00	Apr-03	Nov-03	Dec-04	Dec-05	Mar-07	May-08
Snakes /hectare	31.4	31.6	72.1	14.2	18.7	18.3	17.9	3.7	0.5	0	0

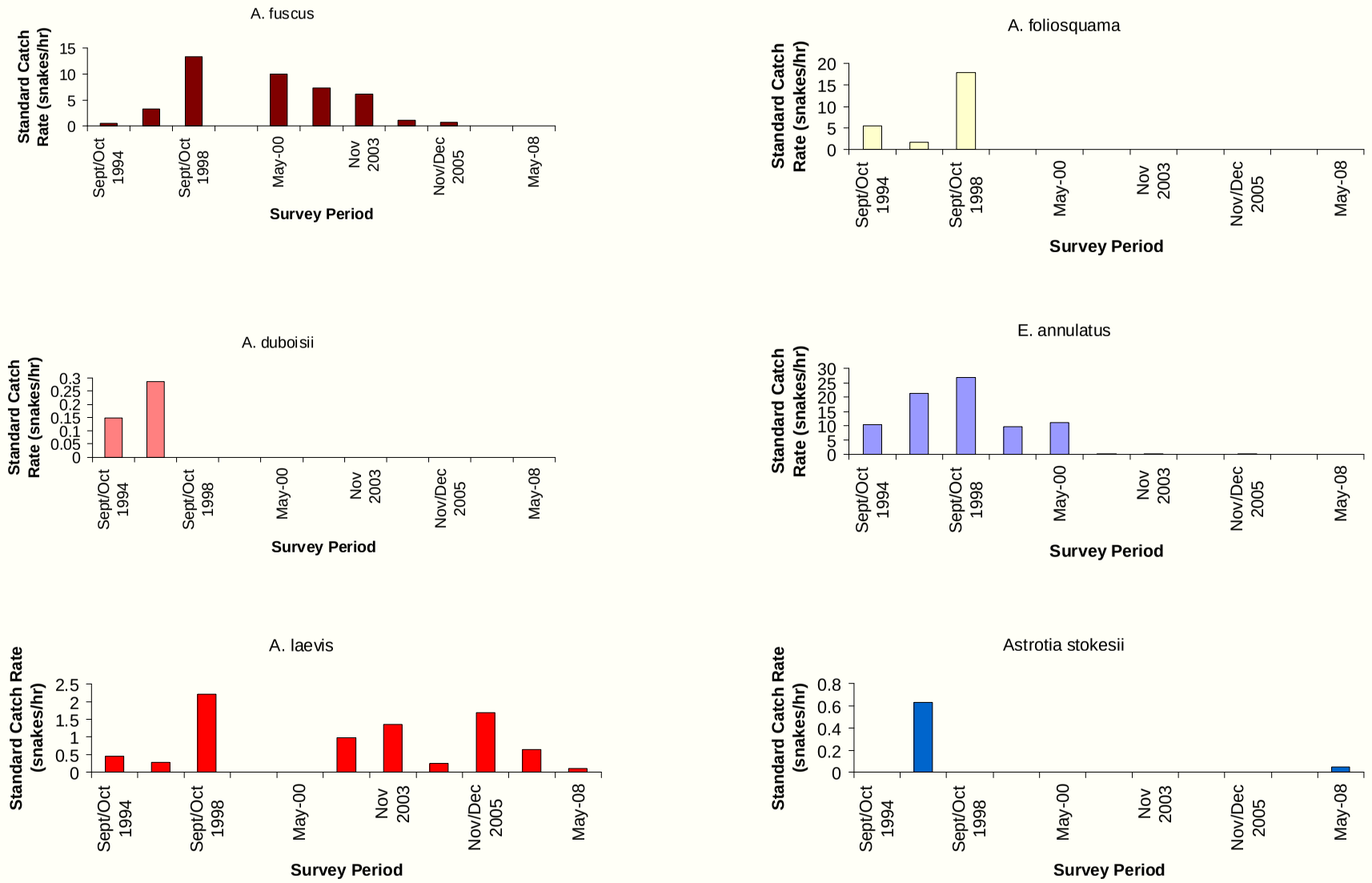

Figure 3 Declines in the numbers of the most common reef dwelling sea snake species at Ashmore Reef from 1994 to 2008

Discussion - What caused the decline in 8 species of reef dwelling sea snakes? There is no smoking gun and no obvious explanation!

The size of “elephant in the room” obscures it presence!

Changes in sea level increasing erosion of the reef flat and sedimentation in the channels and lagoons.

•There is some increase in sedimentation but this could be the natural dynamics of coral islands.

•The corals, algae and seagrass are intact.

Changes in water temperature over the expansive reef flat.

•Surface water temperatures reached 38.5ºC during spring tide exposure with oceanic water at 27ºC seven meters below.

•The corals, algae and seagrass appear unaffected.

Changes in management e.g. increased boat traffic, due to enhanced surveillance and border security by Australian authorities.

•Contract vessels have been at West Island Ashmore Reef since 1986 with no detectable impact on reef and the environment.

Changes to fishing practices by artisanal Indonesian fishers who remove predatory fish e.g. red snapper from the lagoon.

• Sea snakes are missing from inside and outside lagoon and from the waters surrounding the reef.

Increased intensity, proximity and duration of seismic surveys for oil and gas and oil spills in the region. Are sea snakes vulnerable to air cannon compressions and oil ingestion?

•2D and 3D seismic surveys are now centered on the Sahul Shelf and WA coast both areas of high sea snake density (Shuntov 1971).

•**<u>The impact of seismic surveys on sea snakes and oil ingestion has not been tested</u>**.

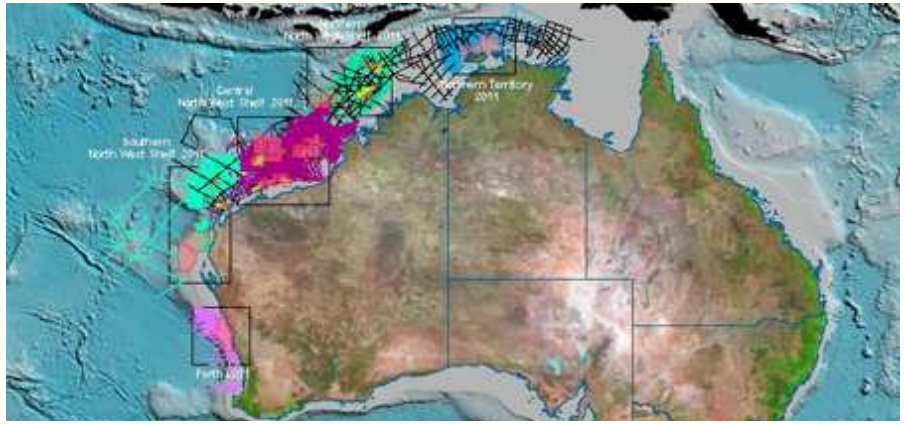

Figure 4 Seismic lines for 2011 for northern Australia
(http://www.ga.gov.au/energy/projects/acreage-release-and-promotion/2011.html).

Acknowledgements and References

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