

Ella Bay Development, Far North Queensland
Expression of Interest in Conducting Research:

Research Topic: Community marine safety: Placement of marine stinger enclosures and educating the community about venomous marine animals

Research Team

<u>Name</u>	<u>Positions</u>	<u>Qualifications</u>
Dr Jamie Seymour	Director, Tropical Australian Stinger Research Unit, JCU	BSc (Hons) PhD
Teresa Carrette	PhD Student, JCU	BSc, Msc
Matthew Gordon	PhD Student, JCU	BSc, (Hons)
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Background and research questions

Then use of the marine environment in tropical Queensland is dependent on the presence or absence of box jellyfish and Irukandji. The presence or absence of these two types of box jellyfish, or cubozoans, determines whether marine water user can safely utilize the marine environment without protective measures being needed. During the stinger season, when both types of jellyfish are present, marine bathers are forced to either use marine stinger enclosures or wear protective clothing, to limit the possibilities of fatal envenomings occurring.

Although the use of stinger enclosures have successfully decreased the deaths by large box jellyfish, there specific placement on a beach front should not be guess work, as the density of box jellyfish often vary widely along the beach, and nets should be placed in areas where low densities occur. For example, at Four mile beach at Port Douglas, many thousands of large box jellyfish (eg *Chironex fleckeri*) can be caught at the southern end of the beach while at the northern end; it is unusual to collect more than a 100 in any one season. Similarly, the density of Irukandji (*Carukia barnesi*) is routinely higher at the northern end of Palm cove than it is at the southern end.

As such, placement of nets for optimal performance and safety should be determined by not only beach shape but also the density of the box jellyfish present. In conjunction wit stinger enclosures, recent work has suggested that education of the public drastically reduces envenomings from not only box jellyfish, but venomous animals as a whole.

This project then aims to

- i) Determine the species and distribution of cubozoans present on the beach front to determine the most appropriate type and position of stinger enclosure required to give maximum community safety and use.
- ii) Determine times of high and low risk for marine users in the area

- iii) Provide information to educate community as to dangers in the marine environment, especially marine stingers, and how best to manage the risk

Methodology

- i) **Determining densities of box jellyfish (both big box jellyfish and Irukandji).** Studies conducted by TASUR (Tropical Australian Stinger Research Unit) in the past has shown that regular sampling during the stinger season (usually November to May) has produced data that allows densities of animals along the beach front to be determined. For large box jellyfish this is achieved by dragging 25 m ‘bait’ nets along the beach front and also using a sampling vessel to spot larger individuals. Once spotted, larger individuals can then be tracked using small radio tags and areas of the beaches preferred by these animals can be determined. For Irukandji, these animals are sampled by placing large underwater lights in the water. Any Irukandji present are attracted to the lights and can be captured and again densities of the animals and preferred areas can be determined. By conducting regular sampling sessions, a real time model to predict the end of the season can be produced, something that TASRU has already done for the Cairns beaches. A full seasons collection (i.e. sampling from late October through until early June) is required to determine the most effective location for the stinger enclosure while a minimum of 3 years data is required to produce a real time model to predict the end of the season as well as high and low risk days.
- ii) **Development of “marine education” facility.** TASRU already has significant literature, DVDS and posters that could be utilized to fill a facility with information that the general public could access. TASRU also has the expertise to develop and display specimens of venomous marine organisms, with the view to educating both visitors and residents of the area

Outcomes

There are several outcome of the proposed research, all of which aim to increase the marine safety of the residences and visitors at Ella Bay. These include, but are not limited to,

- i) Determination of the best location and type of Stinger enclosure.
- ii) Production of a real time model to determine the end of the stinger season as well as high and low risk times within the season itself.
- iii) Education centre with displays etc allowing for the dissemination of information about venomous marine animals, including safe periods of the year, first aid treatment and places for bathers to swim.

Funding

<i>Activity</i>	<i>Funding Requirements</i>	<i>Source of Funding</i>
Distribution and species of cubozoans	55,000 per year	40,000 Sampling vessel JCU 10,000 sampling gear for Irukandji, JCU (lights/generators) 20,000 Marine Tracking Equipment, JCU
Education Material etc	20,000	\$15, 000 JCU(Original documents, posters, DVDs and preserved animal displays)

Dr Jamie Seymour BSc (1986, JCU), Hons (1987, JCU), PhD (1991, JCU)

Dr Jamie Seymour is a senior lecturer in the School of Tropical Biology at James Cook University. He is widely recognized as the leading researcher in the world on the ecology of cubozoans. He is a member of the research board of the Edward Koch Foundation based in Cairns as well as a member of both the research and tourism arm of the Irukandji task force, set up by the Queensland government. He is also the director of the TASRU, the Tropical Stinger Research Unit, a co-operative group involving biological scientists and medical physicians.

Since 1995, his major area of research has been on the factors driving seasonal distributions of tropical invertebrates, specifically tropical insects and tropical Cnidarians. Since then, his research has also encompassed identification and determination of cubozoans responsible for causing Irukandji syndrome and the first aid for envenomed victims. More recently, he has developed projects investigating the ecological reasons for differences in the toxicities of venoms produced by different cubozoans.

He has pioneered techniques for the attachment of transmitters to cnidarians and is the only person so far to have successfully tracked cubozoans. He has also pioneered new techniques for the extraction of venom from cubozoan nematocysts that allows uncontaminated venom to be collected for experimental purposes. He also has developed a photographic atlas of cnidomes of cubozoans for identification purposes to be used by physicians.

He has also developed new techniques that allow the capture of cubozoans with intact tentacles allowing maximum venom return.

The culmination of the major part of his research work in the last 3 years has been the production of a real time model that predicts the start and end of the cubozoan season in the Cairns region. Research is being continued in this area to extend the model's predictive capabilities to encompass the entire east coast of Australia.

Dr Seymour has been involved with several international consultative agreements in relation to the ecology of box jellyfish. In 2000 he was invited to investigate possible reasons for the increase in box jellyfish numbers in Hawaii. His research team was able to conclude that numbers were in fact increasing and that it were related to breeding swarms of cubozoans. In 2003 he was invited by the United Nations to determine if a box jellyfish problem was present in East Timor and if so, devise a solution that would minimise the impact on the armed forces in that area. Within a period of 7 days, his research team was able to ascertain that a problem did exist, and was able to produce a workable solution to allow United Nations Armed Forces to swim but yet minimise the chances of being envenomed. Notable, since its inception, no envenomings have occurred. He is also a consultant to the Australian Armed forces in relation to marine envenomings.

Dr Seymour's research has also been highly publicised in films with his work being featured in at least 18 films, many of which have been international, culminating in a 1 hr Discover Channel documentary on box jellyfish presently being filmed which revolves around his research and a 1 hr special on venoms of the world for National Geographic.

Refereed Publications in last 6 years

- 1) Winter, K.L., G.K. Isbister, **J.E. Seymour**, W.C. Hodgson, _ An in vivo examination of the stability of venom from the Australian box jellyfish *Chironex fleckeri*. *Toxicon* 49 (2007) 804–809.
- 2) Underwood, A., **Jamie E Seymour**. Venom ontogeny, diet and morphology in *Carukia barnesi*, a species of Australian box jellyfish that causes Irukandji syndrome. *Toxicon* 2007 (In press)
- 3) Garm, A., M. M. Coates, R. Gad, **J. Seymour**, D.E. Nilsson. The lens eyes of the box jellyfish *Tripedalia cystophora* and *Chiropsalmus sp.* are slow and color-blind. *J Comp Physiol A* (in press)

- 4) Winter, K.L., G.K. Isbister, **J.E. Seymour**, W.C. Hodgson. An in vivo examination of the stability of venom from the Australian box jellyfish *Chironex fleckeri*. *Toxicon* 49 (2007) 804–809
- 5) M. Little, P. Pereira, T. Carrette, **J. Seymour**. Jellyfish responsible for Irukandji syndrome. *Q J Med* 2006; 99:425–427
- 6) Stone, Richard, Jamie **Seymour**, Oliver Marshall. Plastic containers and the whole-blood clotting test: glass remains the best option. *Transactions of the Royal Society of Tropical Medicine and Hygiene* (2006) 100, 1168—1172
- 7) Cameron S, Pereira P, Mulcahy R, **Seymour J**. Helicopter primary retrieval: tasking who should do it? *Emerg Med Australas*. 2005 Aug;17(4):387-91.
- 8) Loten C, Stokes B, Worsley D, **Seymour JE**, Jiang S, Isbister GK. A randomized controlled trial of hot water (45°C) immersion versus ice packs for pain relief in bluebottle stings. *Med J Aust* 2006; 184:329–333.
- 9) Coughlan, J.P., **J. Seymour** & T. F. Cross. Isolation and characterization of seven polymorphic
- 10) Microsatellite loci in the box jellyfish (*Chironex fleckeri*, Cubozoa, Cnidaria) *Molecular Ecology Notes* (2006)6, 41–43
- 11) **Seymour, Jamie** Box jellyfish and skin damage: The result of venoms or other factors?. *Australasian Journal of Dermatology*. 46 Supplement 2:A38-A39, September 2005
- 12) Canzano, A.A Krockenberger, A.A, Jones R.E., **Seymour, J.E.** Rates of Metabolism in Diapausing and Reproductively Active Tropical Butterflies, *Euploea core* and *E. sylvester* (Lepidoptera: Nymphalidae). *Physiological Entomology* (2006) 31, 184–189
- 13) Carrette, T. & **J.E. Seymour**. Cardiotoxic effects of venom from *Chironex fleckeri* and *Chiropsalmus* sp on an invertebrate model. *Journal of Venomous Animals and Toxins including Tropical Diseases* In Press (accepted Dec 2005)
- 14) Edwards, W., **J. Seymour**, K. Pritchard & P. Brock. Egg production across a 40-week period in the phasmid *Sipyloidea* sp. (Diapheromeridae) from a tropical rain forest, north Queensland, Australia. *Australian Journal of Entomology* In Press (accepted Nov 2005)
- 15) JP Coughlan, **J Seymour** & TF Cross. Isolation and characterisation of eight polymorphic microsatellite loci in the cubomedusan box jellyfish (*Chironex fleckeri*, Cubozoa, Cnidaria) *J. of Mol. Biol* In Press (Accepted Nov 2005)
- 16) Kintner, A, S. Edwards & **J. Seymour**. Variation in lethality and effects of two Australian chirodropid jellyfish venoms, *Chironex fleckeri* and *Chiropsalmus* sp., in fish. *Toxicon* 46 (6): 699-708 NOV 2005
- 17) ** Marc Shorten, John Davenport, **James E. Seymour**, Mary C. Cross, Teresa J. Carrette, Guy Woodward and Thomas F. Cross. Kinematic analysis of swimming in Australian box jellyfish - *Chiropsalmus* sp. and *Chironex fleckeri* (Cubozoa, Cnidaria, Chirodropidae). *Journal Of Zoology* 267: 371-380 Part 4 DEC 2005
- 18) ** Gordon, M., C. Hatcher & **J. Seymour**. Growth and Age Determination Of The Tropical Australian Cubozoan *Chiropsalmus* Sp. *HYDROBIOLOGIA* 530-31: 339-345 2004
- 19) Sachlikidis N G, Jones C M & **Seymour J E**. Reproductive cues in *Panulirus ornatus*. *Australian and New Zealand Journal of Marine and Freshwater Ecology* 39 (2): 305-310 2005
- 20) T. Carrette, **J. Seymour**. Vascular dopplers: a new way of recording cardiac parameters in envenomed organisms. *Toxicon* 45 (4): 541+ MAR 15 2005
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- 22) Ramasamy S, Isbister GK, **Seymour JE**, Hodgson WC. Pharmacologically distinct cardiovascular effects of box jellyfish (*Chironex fleckeri*) venom and a tentacle-only extract in rats. *Toxicology Letters* 2005; 155(2):219-226.
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- 25) ** **J. Seymour**, T. Carrette, P. Sutherland. Do Box jellyfish sleep at Night? *Med J Aust.*, Dec 2004 Vol 118:707
- 26) Isbister GK, Volschenk ES, **Seymour JE**. Scorpion Stings in Australian: five definite stings and a review. *Intern Med J.* 2004 Jul;34(7):427-30.
- 27) Little M, Pereira PL, Mulcahy R, Carrette T, Seymour J Sublingual glyceryl trinitrate as prehospital treatment for hypertension in Irukandji syndrome. *Medical Journal Of Australia* 180 (9): 482-483 MAY 3 2004
- 28) Ramasamy S, Isbister GK, **Seymour JE**, Hodgson WC. The in vivo cardiovascular effects of box jellyfish *Chironex fleckeri* venom in rats: efficacy of pre-treatment with antivenom, verapamil and magnesium sulphate. *Toxicon* 2004;43(6):685-690.
- 29) T. Carrette, **J. Seymour**. A Rapid And Repeatable Method For Venom Extraction From Cubozoans. *Toxicon* 2004. 44: 135-139,
- 30) Little, M., & **J. Seymour**. 2003 Another Cause Of Irukandji Stingings. *Med J. Aust* Vol 179:654.
- 31) ** Nordström, K., R. Wallén, **J. Seymour**, D. Nilsson. 2003. A Simple Visual System Without Neurons In Jellyfish Larvae. *Proc R Soc Lond B Biol Sci.*;270(1531):2349-54.
- 32) Little, M., P. Pereira, R. Mulcahy, P. Cullen, T. Carrette & **J. Seymour**. 2003. Severe Cardiac Failure Associated With Presumed Jellyfish Sting; Can We Really Call It Severe Irukandji Syndrome? *Anesth & Emerg Med.* 31 (6): 642-647 DEC 2003
- 33) Anderson, K., R. Rowe & **J.Seymour** 2003 The Influence of a Dorsal Trash-package on Interactions between *Mallada signata* (Schneider) (Neuroptera:Chrysopidae) larvae. *Aust. J. Entom.* 42:363-366
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- 38) ** Carrette, T., P. Alderlsade & **J. Seymour**. 2002 Cnidome composition and prey preference in two species of cubozoans, *Chironex fleckeri* and *Chiropsalmus* sp. *Toxicon* 40:1547-1551
- 39) **Seymour, J.**, T. Carrette, P. Cullen, R. Mulcahy, M. Little & P. Pereira. 2002 The use of pressure immobilization bandages in the first aid management of cubozoan envenomings. *Toxicon.*40:1503-1505
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- 41) Taylor, D., P. Pereira, **J. Seymour** & K.Winkel. 2002 A sting from an unknown jellyfish species associated with persistent symptoms and raised troponin I levels. *Emerg Med* (Fremantle). 2002 Jun;14(2):175-80
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- 45) **Seymour J.E.** and R.E. Jones. 2001 Geographic variation in host instar and species preference of *Microplitis demolitor* towards two of its native hosts, *Helicoverpa punctigera* and *Helicoverpa armigera*. *Australian Journal of Entomology*. 40: 245-248
- 46) **J.Seymour** & P. Sutherland. 2001. Box jellyfish. *Australian Natural History* Autumn:32-41
- 47) Isbister GK, Little M, **Seymour J** , Jellyfish Stings. *Veterinary And Human Toxicology* 43 (6): 373-374 Dec 2001
- 48) Isbister GK, Ramasamy S, **Seymour JE**, Hodgson WC. Verapamil treatment in severe *Chironex fleckeri* stings. *Toxicon*. 2004 Dec 15;44(8):819-20. [Letter]
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Teresa Carrette

BSc (JCU,2000), MSc (JCU,2003)

Refereed publications in the last 6 years

M. Little, P. Pereira, **T. Carrette**, J. Seymour. (2006) Jellyfish responsible for causing Irukandji Syndrome Quarterly Medical Journal 99: 425-427

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Carrette, T., P. Alderlsade & J. Seymour. (2002) Nematocyst ratio and prey in two Australian cubomedusans, *Chironex fleckeri* and *Chiropsalmus* sp. *Toxicon* 40:1547-1551

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Pereira, P, **T. Carrette**, P. Cullen, R. Mulcahy, M. Little & J. Seymour. (2000) Pressure immobilisation bandages in first aid treatment of jellyfish envenomation: current recommendations reconsidered. *Medical Journal of Australia*, Vol 173:11/12 650-653

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BSc 1996, Hons 1997, JCU

Refereed publications:

Gordon, M., Hatcher, C & Seymour, J. (2004) Growth and age determination of the tropical Australian cubozoans *Chiropsalmus* sp. *Hydrobiologia*: 530/531: 339-345.

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Postgrad. Diploma in European Marketing & Languages, Napier University, Edinburgh, Scotland 1995

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Refereed publications:

Underwood, A., Jamie E Seymour. Venom ontogeny, diet and morphology in *Carukia barnesi*, a species of Australian box jellyfish that causes Irukandji syndrome. *Toxicon* 2007 (In press)