The blue advantage: carotenoprotein pigment in the tropical seastar *Linckia laevigata* is a novel antioxidant defence against extreme environmental stress

Short title: Exploring the role of blue pigment in *Linckia laevigata*

******SUPPLEMENTARY INFORMATION S1******

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Supplementary Data S1. Colour observations of *Linckia laevigata*. Data include new observations by the authors and observations associated with published papers (Strong 1975; Williams and Benzie 1993; Williams and Benzie 1996; Williams and Benzie 1997; Williams and Benzie 1998; Williams 2000; Williams et al. 2002), most of which have not been previously published. Colours have been binned into four categories: blue, purple, orange and brown. NR: colour was not recorded. "Snorkel" is likely <2 m depth but was not noted explicitly. "Reef walking" was on exposed reef. A single number for depth indicates the maximum depth.

Country	Site #, Locality	Habitat notes	Depth (m)	# Samples	Aboral colour: oral colour
Eastern Australia	1. Burke Rf	–	–	40	blue:blue
Eastern Australia	2. Cannon Bay, Palm I.	gungy coral rubble and algae	0.3-1	60	blue:blue
Eastern Australia	3. Curacao Rf	–	–	11	blue:blue
Eastern Australia	4. Curacoa Rf	–	snorkel	2	blue:blue
Eastern Australia	5. Davies Rf	–	–	41	blue:blue
Eastern Australia	6. Davies Rf S1	back reef	–	27	blue:blue
Eastern Australia	7. Davies Rf S2	front reef	–	29	blue:blue
Eastern Australia	8. Dip Rf	–	–	24	blue:blue
Eastern Australia	9. Dugong I., Torres Strait	–	snorkel	26	blue:blue
Eastern Australia	10. Escape Rf Site 1	–	–	53	blue:blue
Eastern Australia	11. Escape Rf Site 2	gungy coral with algae, fire coral	3	58	blue:blue
Eastern Australia	12. Evening Rf Site 1	coral, some algal growth on coral	3	52	blue:blue
Eastern Australia	13. Evening Rf Site 2	coral bombies	4	55	blue:blue
Eastern Australia	14. Gove, NT	–	–	1	blue:blue
Eastern Australia	15. Grub Reef S1	reef flat	3	12	blue:blue
Eastern Australia	16. Grub Reef S2	reef edge	2–3	12	blue:blue
Eastern Australia	17. Grub Reef S3	coral outcrops	3	15	blue:blue
Eastern Australia	18. Grub Reef S4		5	7	blue:blue
Eastern Australia	19. Grub Reef S5	–	19	51	blue:blue
Eastern Australia	20. Heron Is	reef flat	0.5	3	blue:blue
Eastern Australia	21. Holbourne I. Site 1	algae covered reef flat, dead coral	0–2	51	blue:blue
Eastern Australia	22. Holbourne I. Site 2	reef with lots of dead coral	10–14	54	blue:blue
Eastern Australia	23. Imperieuse Rf, WA	reef lagoon with bombies	1.5–2	29	blue:blue
Eastern Australia	24. John Brewer Rf	–	–	50	blue:blue
Eastern Australia	25. John Brewer Rf	–	–	22	blue:blue
Eastern Australia	26. Kirkaldie Rf, Torres Strait	gungy coral, fairly complex	1–1.5	30	blue:blue
Eastern Australia	27. Lizard Island	–	2–3	9	blue:NR
Eastern Australia	28. Lizard Island	–	–	34	blue:blue
Eastern Australia	29. Lizard Island	–	1-2	30	blue:blue
Eastern Australia	30. Lodestone Rf S1	–	–	52	blue:blue
Eastern Australia	31. Lodestone Rf S2	–	–	50	blue:blue
Eastern Australia	32. Myrmidon Rf	–	8	1	purple:purple
Eastern Australia	33. Myrmidon Rf	–	–	50	blue:blue
Eastern Australia	34. Orpheus I.	reef flat	–	49	blue:blue
Eastern Australia	35. Pith Rf	back reef around lighthouse	–	30	blue:blue

Eastern Australia	36. Reef 22112 S1	reef flat	1–2	51	blue:blue
Eastern Australia	37. Reef 22112 S2	algal growth	2–3	50	blue:blue
Eastern Australia	38. Rib Rf	–	–	50	blue:blue
Eastern Australia	39. Rib Rf	–	–	27	blue:blue
Eastern Australia	40. Rib Rf	reef flat in surf zone, coral rubble, brown algae, sandy patches	2–3	hundreds	blue:blue
Eastern Australia	41. Sanctuary Reef S1	–	2	50	blue:blue
Eastern Australia	42. Sanctuary Reef S2	–	3	54	blue:blue
Eastern Australia	43. South end Escape Rf Site 1	reef flat	3	66	blue:blue
Eastern Australia	44. Sykes Rf S1	coral patches and reef flat	0.5–3	50	blue:blue
Eastern Australia	45. Sykes Rf S2	near reef front, lots of complex coral cover, algae	1–1.5	52	blue:blue
Eastern Australia	46. Tern Island Site 1	reef flat	<1	51	blue:blue
Eastern Australia	47. Tern Island Site 2	reef flat	<0.5	51	blue:blue
Western Australia	1. Clerke Rf	reef lagoon	snorkel	30	blue:blue
Western Australia	2. Imperieuse Rf	–	–	29	blue:blue
Western Australia	3. Mermaid Rf	reef flat	snorkel	20	blue:blue
Western Australia	4. Mermaid Rf	reef flat	snorkel	lots	blue:blue
Western Australia	5. Ningaloo	–	–	9	blue:blue
Western Australia	6. Ningaloo	–	–	9	blue:blue
Western Australia	7. Scott Rf North	reef flat	snorkel	30	blue:blue
Western Australia	8. Scott Rf, South East Hook	–	snorkel	30	blue:blue
Western Australia	9. Serangapatam Rf	reef flat	reef walking	30	blue:blue
Fiji	1. Dravuni I.	–	–	30	blue:blue
Fiji	2. Suva	–	–	30	blue:blue
Guam	3. Asan Bay	–	–	30	blue:blue
Guam	4. Luminao	–	–	20	blue:blue
Guam	5. Tumon	–	–	10	brown:brown
Guam	6. Hilaan Pt	See Strong (1975)	mean: 12.5	174	brown:brown
Guam	7. Tanguisson Pt	See Strong (1975)	mean: 9	1	blue:blue
Guam	7. Tanguisson Pt	See Strong (1975)	mean: 11	67	brown:brown
Guam	8. Neye I,	See Strong (1975)	mean: 7.1	72	blue:blue
Guam	8. Neye I,	See Strong (1975)	mean: 10.7	16	brown:brown
Guam	9. Anae I.	See Strong (1975)	mean: 3	91	blue:blue
Guam	10. Merizo	See Strong (1975)	mean: 3	4	blue:blue
Guam	11. Cocos patch reef	See Strong (1975)	mean: 5.3	5	blue:blue
Indonesia	1. Bali	–	–	49	blue:blue
Indonesia	1. Bali	–	–	3	blue:orange
Indonesia	2. Melintang	–	–	3	blue:blue
Indonesia	2. Melintang	–	–	2	blue:orange
Indonesia	2. Melintang	–	–	1	orange:orange
Indonesia	3. Sekotong, Lombok	–	–	35	blue:blue

Indonesia	3. Sekotong, Lombok	–	–	2	blue:orange
Japan	1. Bise, Okinawa	reef flat and lagoon	0–1	3	blue:orange
Japan	1. Bise, Okinawa	reef flat and lagoon	0–1	3	blue:blue
Japan	2. Kasaishi Marine Park, Okinoerabu Is., Kagoshima Pref.	reef flat	<0.5	4	blue:blue
Japan	2. Kasaishi Marine Park, Okinoerabu Is., Kagoshima Pref.	reef flat	<0.5	1	blue:orange
Japan	3. Kyoda, Okinawa	reef lagoon	1–3	6	blue:orange
Japan	3. Kyoda, Okinawa	reef lagoon	1–3	6	blue:blue
Japan	4. Sesoko, Okinawa	reef lagoon	1–3	14	blue:blue
Japan	4. Sesoko, Okinawa	reef lagoon	1–3	34	blue:orange
Japan	4. Sesoko, Okinawa	reef lagoon	1–3	3	orange:orange
Japan	5. Okinawa	–	–	20	blue:blue
Japan	5. Okinawa	–	–	5	blue:orange
Japan	5. Okinawa	–	–	3	orange:orange
Japan	6. Yadori Beach, Sokaru, Setouchi, Amami I.	reef flat	<0.5	1	blue:orange
Japan	6. Yadori Beach, Sokaru, Setouchi, Amami I.	reef flat	<0.5	2	blue:blue
New Caledonia	1. –	–	–	19	blue:blue
New Caledonia	2. Koumac	reef flat and lagoon	0–2	9	blue:blue
Philippines	1. Dumaguete, Negros	seagrass and coral patches	4	41	blue:blue
Philippines	1. Dumaguete, Negros	seagrass and coral patches	4	1	blue:orange
Philippines	1. Dumaguete, Negros	seagrass and coral patches	4	1	orange:orange
Philippines	1. Dumaguete, Negros	seagrass and coral patches	4	7	purple:purple
Philippines	2. Lucero and Silaqui, Bolinao	reef flats	4	39	blue:blue
Philippines	2. Lucero and Silaqui, Bolinao	reef flats	4	10	blue:orange
Philippines	3. Silaqui, Bolinao	giant clam grow out area	2	17	blue:blue
Philippines	3. Silaqui, Bolinao	giant clam grow out area	2	4	blue:orange
Solomon Is	1. ICLARM Coastal Aquaculture Centre, Aruligo, Guadalcanal	–	–	17	blue:blue
Solomon Is	2. Gizo, Ghizo I.	–	–	30	blue:blue
South Africa	1. Various reefs in the St. Lucia and Maputaland Marine Reserves	–	5–20	6	orange:orange
South Africa	1. Various reefs in the St. Lucia and Maputaland Marine Reserves	–	5–20	1	purple:purple
South Africa	1. Various reefs in the St. Lucia and Maputaland Marine Reserves	–	5–20	2	blue:blue
Thailand	1. Kata Beach, Phuket Marine Station and Waeo I.	–	4–5	2	blue:purple
Thailand	1. Kata Beach, Phuket Marine Station and Waeo I.	–	4–5	3	blue:orange
Thailand	2. South coast, Ko He I., Phuket	–	2–18	24	purple:purple
Thailand	2. South coast, Ko He I., Phuket	–	2–18	26	orange:orange