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The ecology of coral larvae: settlement patterns, habitat selection and the length of the
larval phase.

Thesis submitted by

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in April 2001

For the degree of Doctor of Philosophy
in Marine Ecology
within the School of Marine Biology and Aquaculture
James Cook University

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Abstract

In order to increase the taxonomic resolution achievable in coral juveniles I compared skeletal morphology of juveniles from known parents from 19 species in 14 genera and 8 families to determine which of these taxa could be reliably distinguished. Three families had features which were both unique and consistent, enabling unequivocal classification throughout their life: the Acroporidae have a porous coenosteum, prominent basal ridges or septa and no columella; the Pocilloporidae have a solid coenosteum, prominent septa and a prominent columella; the Poritidae have septa with prominent teeth. Juveniles in the remaining 5 families examined could not be consistently distinguished. Some genera could be distinguished while the juveniles were young, including the genera of the Pocilloporidae and the Acroporidae. The juveniles of broadcast spawned *Porites* could be distinguished from those of brooded *Porites* by the presence of an epitheca. After this time, variation in the growth rates of individuals and thickening of the skeleton obscure differences between the taxa.

I next examined the depth patterns of coral settlement around Lizard Island. Many taxa showed a pronounced and consistent decline in abundance with depth. In particular, *Isopora* and *Pocillopora* recruits were largely restricted to the reef crest. A similar pattern was evident in the adults of these taxa, suggesting that larvae can recognize and respond to cues from the parental habitat. To test this hypothesis the larvae of six common coral species, with contrasting depth distributions, were introduced into aquaria containing tiles conditioned at depths of 2 m and 12 m. Settlement densities on tiles matched those predicted from the depth distribution of adults. I next examined the induction of metamorphosis in larvae of the brooding corals *Stylophora pistillata* (F.

Pocilloporidae) and *Acropora palifera* (F. Acroporidae). *A. palifera* metamorphosed only in assays which included CCA. In contrast, some *S. pistillata* larvae metamorphosed in all assays, including sterilized seawater, which suggests that *S. pistillata* larvae do not require a biologically conditioned surface to settle.

To test the likelihood of localised recruitment and the potential of coral larvae for long distance dispersal, I compared the frequency distribution of settlement and the competence of larvae of five *Acropora* and two faviid corals. Some settlement was recorded within 4 days of gamete release in all species, indicating a shorter pre-competent period than has been generally accepted. Pronounced differences were also apparent among species in the capacity to delay metamorphosis. Settlement competence peaked between 7-10 days, after which the proportion competent to settle dropped rapidly in all species except *A. valida* and *A. millepora*. The maximum competency periods were 110 days for *A. valida*, 60 days for *A. millepora*, 36 days for *G. retiformis*, 34 days for *A. gemmifera* and *P. daedalea* and 14 days for *A. pulchra*. However, larval survivorship in cultures was low in all species. Low survivorship of larvae combined with a rapid drop in the proportion remaining competent to settle suggests that while connections between populations may be sufficient to prevent population divergence the numbers of migrants are unlikely to be high.

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Table of contents

TITLE PAGE.....	1
STATEMENT OF ACCESS	2
Abstract.....	3
Acknowledgements	5
Table of contents	6
List of illustrations.....	9
STATEMENT OF SOURCE	13
CHAPTER 1 General Introduction	14
1.1 Introduction	14
1.1 Thesis outline.....	16
CHAPTER 2 The identification of coral recruits	19
2.1 Introduction	19
2.2 Materials and methods.....	21
2.3 Results	23
2.3.1 Family Acroporidae.....	23
Subgenus <i>Acropora</i>	23
Subgenus <i>Isopora</i>	23
Genus <i>Montipora</i>	24
2.3.2 Family Agaricidae	25
2.3.3 Family Dendrophylliidae.....	25
2.3.4 Family Faviidae	26
2.3.5 Family Fungiidae.....	27
2.3.6 Family Merulinidae	28
2.3.7 Family Pocilloporidae	28

2.3.8 Family Poritidae	30
2.4 Discussion.....	31
CHAPTER 3. The depth zonation of coral assemblages.....	62
3.1 Introduction	62
3.2 Materials and methods.....	64
3.2.1 Coral settlement patterns and the depth distribution of adults at Lizard Island	64
3.2.2 Habitat selection by larvae and the depth distribution of adults	65
3.3 Results	67
3.3.1 Coral settlement patterns and the depth distribution of adults at Lizard Island	67
3.3.3 Habitat selection by larvae	69
3.4 Discussion.....	70
3.4.1 Depth distribution of coral taxa around Lizard Island.....	70
3.4.2 Larval habitat selection.....	71
CHAPTER 4. Induction of metamorphosis in larvae of the brooding corals <i>Stylophora</i> <i>pistillata</i> and <i>Acropora palifera</i>	96
4.1 Introduction	96
4.2 Materials and methods.....	98
4.3 Results and discussion.....	100
CHAPTER 5 The length of the larval phase in corals.....	107
5.1 Introduction	107
5.2 Materials and methods.....	112
5.2.1 Study species	112
5.2.2 The potential of larvae for localised recruitment	113

5.2.3 Larval development.....	114
5.2.4 The potential for long-distance dispersal in broadcast spawning larvae.....	114
5.3 Results	116
5.3.1 The potential of larvae for localised recruitment	116
5.3.2 Larval development.....	117
5.3.3 The potential for long-distance dispersal in broadcast spawning larvae.....	118
5.4 Discussion.....	120
5.4.1 The potential for localised recruitment.....	120
5.4.2 Larval development.....	125
5.4.3 Long distance dispersal and coral biogeography.....	127
CHAPTER 6 General conclusions	153
References	158
APPENDIX ONE: Publications during the course of Ph D candidature	179

List of illustrations

Figure 2.1	Patterns of skeletogenesis Subgenera <i>Acropora</i>	43
Figure 2.2	Patterns of skeletogenesis Subgenera <i>Isopora</i>	44
Figure 2.3	Patterns of skeletogenesis <i>Montipora digitata</i>	45
Figure 2.4	Patterns of skeletogenesis <i>Pachyseris speciosa</i>	46
Figure 2.5	Patterns of skeletogenesis <i>Turbinaria mesenterina</i>	47
Figure 2.6	Patterns of skeletogenesis <i>Goniastrea aspera</i> and <i>G. retiformis</i>	48
Figure 2.7	Patterns of skeletogenesis <i>Leptoria phrygia</i>	49
Figure 2.8	Patterns of skeletogenesis <i>Platygyra daedalea</i>	50
Figure 2.9	Patterns of skeletogenesis <i>Fungia horrida</i>	51
Figure 2.10	A wild <i>Fungia</i> spp. spat on pumice	52
Figure 2.11	Patterns of skeletogenesis <i>Hydnophora excesa</i> and <i>Merulina ampliata</i>	53
Figure 2.12	Patterns of skeletogenesis <i>Seriatopora hystrix</i> , <i>Stylophora pistillata</i> and <i>Pocillopora damicornis</i>	54
Figure 2.13	<i>Seriatopora hystrix</i> , <i>Stylophora pistillata</i> and <i>Pocillopora damicornis</i> 2 months old	55
Figure 2.14	Mean diameter of the primary corallite (SE) as a function of age since larval release in <i>Seriatopora hystrix</i> , <i>Stylophora pistillata</i> and <i>Pocillopora damicornis</i> recruits.	56
Figure 2.15	Mean diameter of the basal disc (SE) as a function of age since larval release in <i>Seriatopora hystrix</i> , <i>Stylophora pistillata</i> and <i>Pocillopora damicornis</i> recruits.	57

Figure 2.16	Patterns of skeletogenesis <i>Porites australiensis</i>	58
Figure 2.17	Patterns of skeletogenesis <i>Porites cylindrica</i>	59
Figure 2.18	Wild brooded <i>Porites</i> sp. recruits	60
Figure 2.19	The relationship between propagules size at release and spat size at settlement	61
Figure 3.1	Lizard Island showing the four locations used in the study.	85
Figure 3.2	A recruitment panel on the reef crest at Lizard Island.	86
Figure 3.3	Study species	87
Figure 3.4	Mean number of acroporid recruits per panel around Lizard Island	88
Figure 3.5	Mean number of <i>Isopora</i> recruits per panel around Lizard Island	89
Figure 3.6	Mean number of <i>Pocillopora</i> recruits per panel around Lizard Island	90
Figure 3.7	Mean number of <i>Pocillopora</i> recruits per panel around Lizard Island	91
Figure 3.8	Mean number of <i>Seriatopora</i> recruits per panel around Lizard Island	92
Figure 3.9	Mean number of <i>Stylophora</i> recruits per panel around Lizard Island	93
Figure 3.10	Mean number of poritid recruits per panel around Lizard Island	94
Figure 3.11	Mean number of “other” recruits per panel around Lizard Island	95
Figure 4.1	Study species	105

Figure 4.2	The mean proportion of larvae completing metamorphosis.	106
Figure 5.1	Broadcast spawning corals used in experiments	135
Figure 5.2	Brooding corals used in experiments	136
Figure 5.3	<i>Acropora</i> distributions	137
Figure 5.4	Stages in the embryogenesis of <i>Acropora millepora</i>	138
Figure 5.5	The proportion of the cohort of the larvae of seven species of broadcast spawning corals settling through time	139
Figure 5.6	The cumulative proportion of the cohort of the larvae of seven species of broadcast spawning corals settling through time	140
Figure 5.7	The proportion of the cohort of the larvae of two species of brooding corals settling through time	141
Figure 5.8	The cumulative proportion of the cohort of the larvae of <i>Seriatopora hystrix</i> and <i>Stylophora pistillata</i> settling through time	142
Figure 5.9	The rate of embryogenesis in two coral species	143
Figure 5.10	The rate of embryogenesis in two coral species	144
Figure 5.11	Larval size and development: onset of larval motility	145
Figure 5.12	Larval size and development: peak settlement	146
Figure 5.13	The proportion of the cohort of four species of <i>Acropora</i> remaining competent to settle through time	147
Figure 5.14	The proportion of the cohort in two faviid species remaining competent to settle through time	148
Figure 5.15	Survivorship in larval cohorts in 6 species.	149
Figure 5.16	Planktonic metamorphosis of <i>Acropora valida</i> larvae	150

- Figure 5.17 The mean size of larvae through time in 4 species of *Acropora* 151
- Figure 5.18 The mean size of larvae through time in two faviid species 152

STATEMENT OF SOURCE

DECLARATION

I declare that this thesis is my own work and has not been submitted in any form for another degree or diploma at any university or institution of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of references is given.

(Name)

7.5.2001
