CORAL BREEDING REFERENCE SHEETS

Porites porites
(Club tip finger coral, Pallas 1766)

Chamberland VF, Latijnhouwers KRW, Delvoye L, Bennett M-J, Le Trocquer N, ter Horst L, Huckeba J, Schneider J, van Duijnhoven J

1. Adult colony

Distribution: 0.5–35 m depth in the Caribbean, Bahamas, Southern Florida, Bermuda, Gulf of Mexico, Atlantic coast of Central America, and the Atlantic Coast of Africa

Reproductive biology [1,2]

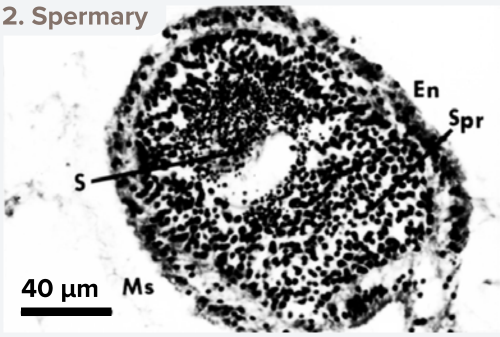
Reproductive mode:	**brooding**
Sexual system:	**gonochoric/hermaphoditic**
Sex ratio:	**variable**
Mature oocyte size:	**280–490 µm (10)(Ø, Stage III)**

Values = average ± SD (n)

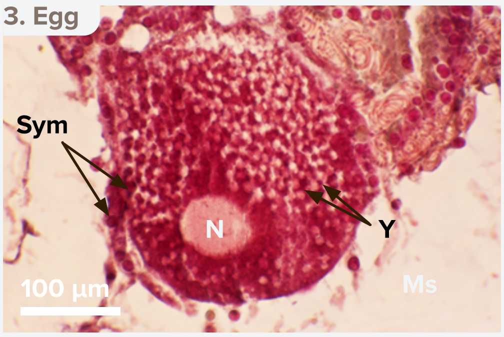
Noteworthy observations on this species' reproductive biology: Histological analyses of over 600 specimens in Barbados revealed this species to be predominantly gonochoric, with a low incidence of hermaphrodism (3%). In Curaçao, not a single male reproductive structure was observed in histological slides prepared from ~90 colonies sampled semi-monthly between 2018–2020. If gravid, specimens either contained eggs, larvae or both, but never sperm. The absence of spermaries in all colonies could indicate the production of asexual (clonal) larvae via parthenogenesis in this species, though this was not confirmed.

Gametogenesis and larval development [2]

2. Spermary

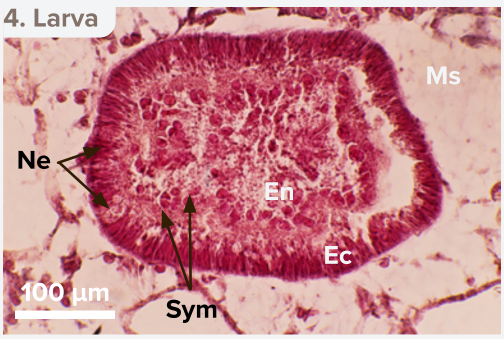


3. Egg

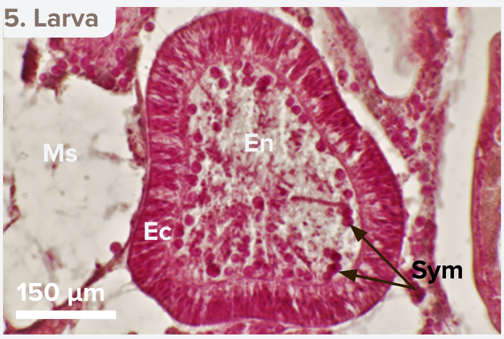


Ectoderm (EC)
Endoderm (En)
Mesoglea (Ms)
Spermatocytes (Spr)
Spermatozoa (S)
Yolk granules (Y)
Symbiodiniacea (Sym)
Nucleolus (N)
Nematocyst (Ne)

4. Larva



5. Larva



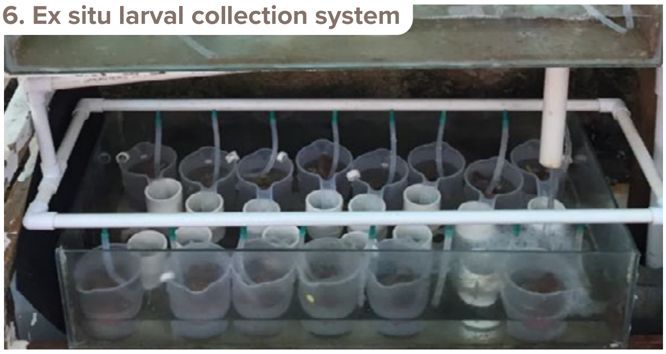
Noteworthy observations on this species' gametogenesis and larval development: Eggs and larvae at different stages of development are often observed simultaneously in the same tissue sections. This could indicate (i) multiple fertilization events that occurred at different times within the maternal colony, (ii) different development rates of eggs/larvae within the same maternal colony, and/or (iii) the production of asexual larvae through parthenogenesis (absence of meiosis) thus not requiring a fertilization event. Eggs contain symbiotic dinoflagellates (Symbiodiniaceae) and some developing larvae already contain nematocysts. Tomascik and Sander (1987) provide in depth details on this species' gametogenesis and larval development via histological time series.

Reproductive timing and larval collection [1,2]

Months (Barbados)	January–March	April–September	November–December	
Months (Curaçao)	March-June	July-August	September-October	November-February
Days after new moon	1 2 3 4 5 6 7 8 9 10 11 12 13	14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	29 30	
Time of day	Daytime	Nighttime		

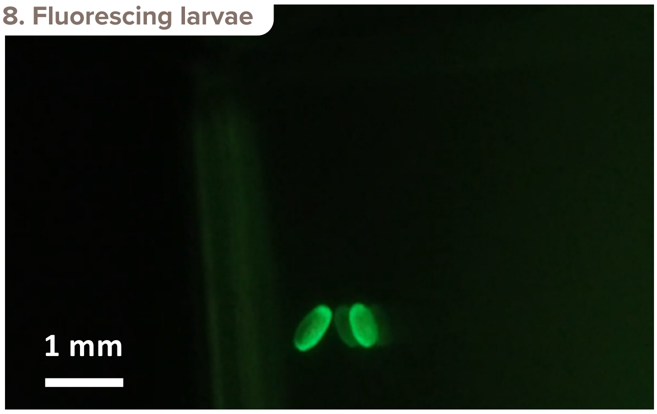
- possible
- likely
- very likely
- unlikely

6. Ex situ larval collection system



7. Larval collection cup

8. Fluorescing larvae



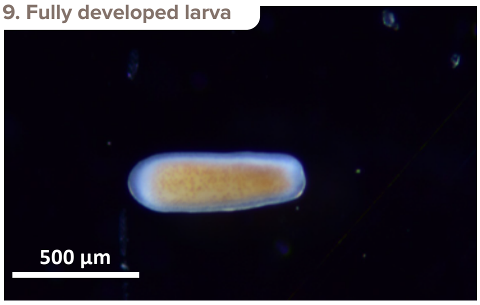
Considerations for larval collection: In Curaçao (Southern Caribbean), larval release is seasonal with peak production in the spring (March–June), and with no to very limited larval release during the summer (July–August). In Barbados, larval production also peaks in the winter (November-March) with no larval release in spring and summer months (April-September). Larval release is concentrated in the two weeks following the full moon. Note that larval release mostly occurs at night but can also occur during daytime (20% ± 8SE, n=21 days). Larvae are less buoyant than most other brooding coral species, but it is still possible to collect them using a classical ex situ flow-through larval collection system reliant on the overflow of positively buoyant larvae into a collection cup, as displayed in picture 6.

Larval behavior, settlement, and metamorphosis [1,2]

Larval size:	**650 ± 90 µm (42) (longest axis)**
Symbiont transfer mode:	**vertical (within eggs)**
Larval feeding mode:	**lecithotrophic**
Onset of bright green fluorescence:	**0 hrs PR (upon release)**
Time to motility:	**0 hrs PR (upon release)**
Time to directed swimming:	**0 hrs PR (upon release)**
Time to negative buoyancy:	**0 hrs PR (upon release)**
Onset of settlement	**21 hrs PR* (1st observation)**
Peak window of competency:	**4–12 days PR***
Substrate preference:	**not yet available**
Habitat preference:	**topsides of horizontal surfaces**

PR = post-release
Values = average ± SD (n)
*In the presence of settlement cues (crustose coralline algae, *Hydrolithon boergesenii)*

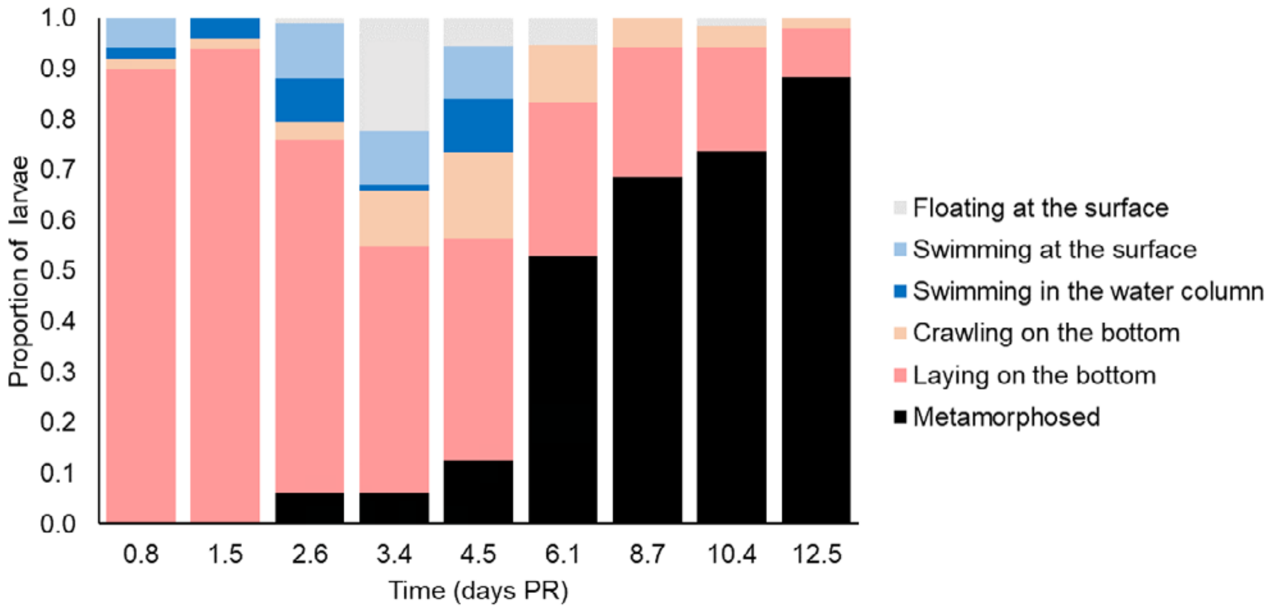
9. Fully developed larva



10. Metamorphosed

Considerations for larval rearing: Larvae fluoresce and are motile upon release, but only reach peak competency a few days later, even in the presence of settlement-inducing CCA species. In Curaçao, multiple settlement trials resulted in highly variable settlement success (≤5–40 % of larvae), the causes of which are unclear.

Larval behavior, settlement, and metamorphosis through time



Post-metamorphosis development and ecology [1-3]

Initial primary polyp size:	**735 ± 42 µm (2) (Ø)**
Onset of calcification:	**2-4 days PM**
Skeleton morphology:	**not yet available**
Time to first polyp budding:	**not yet available**
Budding mode:	**not yet available**
Age to sexual maturity:	**not yet available**
Minimum size at sexual maturity:	**not yet available**

Values = average ± SD (n)
PM = post-metamorphosis

Considerations for early post-metamorphosis rearing: Settlers complete metamorphosis and initiate skeleton formation within 2–4 days after settlement. Five-day-old primary polyps are able to capture and ingest *Artemia* spp. nauplii, potentially enhancing growth and survival rates. Settlers reared in an aquarium system in Jamaica were found to have higher survival rates if settled on horizontal surfaces than on vertical surfaces, and increased survival once initiating basal plate deposition, septal insertion and calyx growth. To date, *P. porites* settlers have not been reared in an ex situ setting for extended periods of time and it is unknown when first polyp divisions occur.

11. Post-metamorphosis development

Long-term ex situ rearing [3]

Species susceptibilities:	**not yet available**
Known threats:	**not yet available**
Optimal light availability:	**not yet available**
Optimal water flow:	**not yet available**
Onset of heterotrophic feeding:	**This species is able to capture and ingest *Artemia* spp. nauplii starting at the age of 5 days following metamorphosis.**
Optimal diet:	**not yet available**

Captive larval release

Main cues for ex situ larval release:	**full moon**
Specific settings for abiotic parameters:	**not yet available**
Research groups that have attempted ex situ larval collection of this species:	**SECORE International & CARMABI Marine Research Station, Curaçao**

Additional considerations for captive larval release: Parental colonies kept in a flow through aquarium system in Curaçao did not remain healthy over extended periods in captivity (>4 weeks), but recovered quickly once returned to the reef. It is therefore recommended to allow colonies to alternate between captive (aquaria) and natural reef (mid-water nursery) conditions.

Sources

References
[1] Goreau NI, Goreau TJ, Hayes RL (1981) https://www.ingentaconnect.com/content/umrsmas/bullmar/1981/00000031/00000002/art00012
[2] Tomascik T, Sander F (1987) https://doi.org/10.1007/BF00392900
[3] Geertsma RC et al. (2022) https://doi.org/10.1007/s00338-022-02310-2

Unpublished data
Reproductive biology: Chamberland VF[1,2,3], Latijnhouwers KRW[1,2,3], Delvoye L[2], Bennett M-J[1], Le Trocquer N[1]
Gametogenesis and larval development: Chamberland VF[1,2,3], Latijnhouwers KRW[1,2,3], Delvoye L[2], Bennett M-J[1], Le Trocquer N[1]
Reproductive timing and larval collection: Chamberland VF[1,2,3], Latijnhouwers KRW[1,2,3], Delvoye L[2], Bennett M-J[1], Le Trocquer N[1], ter Horst L[1,3], Schneider J[1,4], van Duijnhoven J[1,5], Huckeba J[1,3]
Larval behavior, settlement and metamorphosis: Chamberland VF[1,2,3], Latijnhouwers KRW[1,2,3], ter Horst L[1,3]
Post-metamorphosis development and ecology: Chamberland VF[1,2,3], Latijnhouwers KRW[1,2,3]
Captive larval release: Chamberland VF[1,2,3], Latijnhouwers KRW[1,2,3], ter Horst L[1,3], Schneider J[1,4], van Duijnhoven J[1,5], Huckeba J[1,3]

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Photo credits
Chamberland VF, Delvoye L, Selvaggio P, ter Horst L, Tomascik T, Valdez Trinidad A, Vanegas J

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