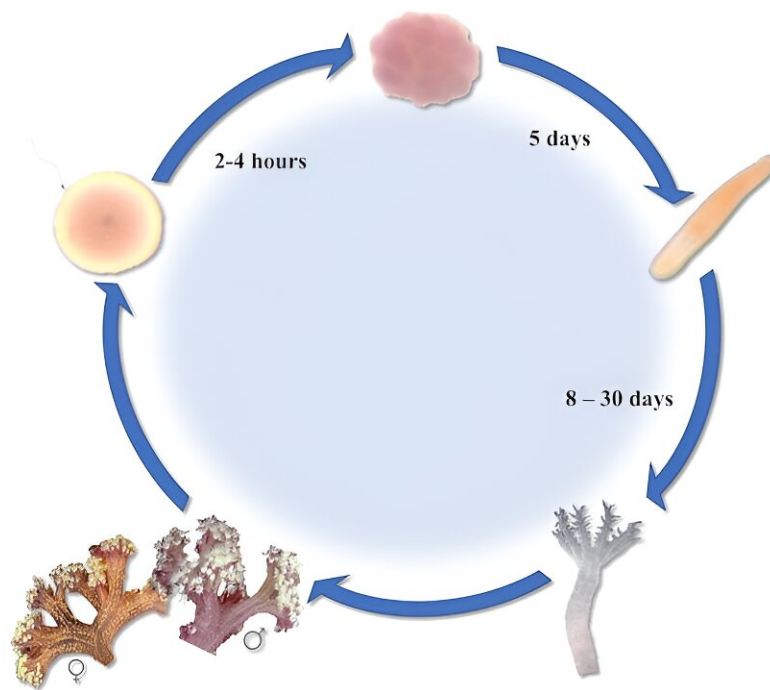


# Sex life discovery raises IVF hope for endangered purple cauliflower soft coral

September 23 2023, by Meryl Larkin, David Harasti, Kirsten Benkendorff, Stephen D. A. Smith and Tom R Davis



The life cycle of the purple cauliflower coral *Dendronephthya australis* begins with an egg being fertilised by sperm, proceeds to embryo cell division within 2-4 hours, to fully grown larvae by day 5, to metamorphosis to polyp from 8 days of age. Credit: Meryl Larkin

Vital coastal habitat was destroyed in the devastating floods that hit New South Wales in 2021 and 2022.

The purple cauliflower soft coral *Dendronephthya australis*, now listed as an [endangered species](#), was almost completely wiped out in the Port Stephens estuary and along the coast. That's a tragedy because this coral shelters young snapper and the endangered White's seahorse.

Unfortunately, a lack of knowledge hampered recovery efforts—until now.

In [our new research](#) we discovered how the coral reproduces. We used IVF (in-vitro fertilization) to create baby coral in the lab. And we successfully transplanted the coral into the wild. This offers new hope for the survival of the species.

## **Variety is the spice of life**

Corals have a complicated sex life. There's more than one way to "do it". And gender varies too.

Corals can reproduce asexually, meaning they create genetic copies of themselves. This process often entails shedding polyps that can attach to reefs to form new colonies.

Using this process is a common approach for coral restoration. It's a bit like propagating plants. Cuttings or fragments are removed from adult colonies, briefly maintained in the lab, and then new corals are transplanted into the wild. This isn't a simple process for soft corals, though we have been exploring [ways to make this work](#) for *Dendronephthya australis*.

Many corals are hermaphrodites, which means they have both male and female reproductive organs. Others form colonies that are entirely male or female. And some mix or swap sexes.

Spawning is the release of eggs and sperm. Again, corals can use various techniques. Broadcast spawning is where eggs and sperm are released into the water column. Brooding is where eggs are fertilized within colonies and later released as larvae.

But until sexual reproduction of an individual species is observed, their sex life remains a private matter.

## **A chance discovery in the lab**

We were growing coral in the lab, raising asexual clones from fragments, when we noticed something unusual.

There were small orange dots inside some of the corals. These were much larger than the grains of dry orange "coral food" we fed them. So they had to be something else.



Unfertilised eggs (orange dots) were observed in *Dendronephthya australis* fragments for the first time. Credit: Meryl Larkin

We soon realized the orange dots were unfertilised eggs. Half of the fragments in our care contained eggs. As sperm is much smaller, we had to sacrifice small portions of the remaining coral fragments for closer inspection of their contents (under a microscope). In doing this, we discovered the other half were sperm-bearing.

As fate would have it, we had collected fragments from two donor colonies—one female and one male. By chance, we discovered

*Dendronephthya australis* is "gonochoric" (meaning colonies are either male or female).

We watched the corals carefully over the following weeks and made more discoveries. Females spawned (released their eggs) around the "neap tide" (when the moon appears half full) during the summer months.

Maybe the coral evolved to spawn when tidal currents are slowest, to maximize the chance of fertilization.

## **Coral IVF for making babies**

We used IVF techniques to fertilize harvested eggs. Cell division occurred within hours. Mobile larvae grew over the following week.



Researchers achieved larval settlement, witnessing the change to the single polyp stage of the soft coral. Credit: David Harasti

From eight days of age, the larvae started to transform into polyps; we were the first people to witness these tiny cauliflower coral babies (as single polyps).

Within just a few weeks, we had produced 280 babies from just a few coral fragments.

Understanding how the purple cauliflower coral reproduces is important for several reasons:



- maintaining genetic diversity: if the sex ratio becomes unbalanced, the effective population size will be lower than the total number of remaining individuals
- achieving fertilization: broadcast spawning in corals is density-dependent. That means if more colonies are lost, the chance of natural sexual reproduction decreases
- restoring [gender balance](#): any attempt to grow more coral from fragments will need to ensure both male and female colonies are represented
- scaling up production: sexual reproduction provides an opportunity to raise more baby corals while maintaining [genetic diversity](#) in the population.

## Ongoing restoration work

Since this discovery, we have successfully repeated these IVF techniques. We transplanted hundreds of coral babies and released thousands of larvae back into Port Stephens.



Four-month-old juvenile coral transplanted in Port Stephens. Credit: Meryl Larkin

Early results suggest some IVF babies survived at least the first 18 months and performed better than the asexual fragments.

We plan to implement the IVF program annually. We're optimistic that we can boost the population of this endangered [coral](#) in ways never thought possible.

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