

## Coral propagation at Plantages PortoMari

### Summary

To my opinion, once corals are damaged they are weakened and postponed to several dangers. Algae can start growing on damaged parts and from there also cover healthy tissue that will then suffer from food starvation and light reduction weakening the coral even more. Algae also attract predators, presumably parrotfish that not only scrape the algae but also can damage large parts of healthy coral tissue doing so. My observations are that especially with *Porites porites* and *Madracis mirabilis* (finger and pencil coral) recovery (regeneration of damaged tissue) of such predator actions can easily occur within a month as long as there is enough living tissue left and no further impact on the coral fragments occurs. This may indicate that predators can destroy coral fragments but also rescue them from coverage by algae.

*Agaricia agaricites* has adaptation problems in the beginning that are shown by bleaching. However as long as they hold, don't show damaged tissue and don't get too much "attacks" from algae they show a very healthy appearance after 4 to 5 months. Algae can block outgrow at the base but when the algae are gone clear outgrow has been observed.

*Eusmilia fastigiata* seems to withstand algae growth very well and after a short period of showing signs of stress (bleaching), damaged tissues heal very fast and the fragments look good.

High survival of corals with slow growth rates like *Montastrea annularis*.

*Madracis* and *Acropora* are very fragile and easily damaged (mechanical damage e.g. kicking of fins). *Madracis* recovers very fast. Growth tips of *Acropora* as well.

Branching corals are very susceptible for breakage and therefore developed the capability to recover fast. New tissue grows on broken parts and new colonies originate this way. This capacity of fast asexual reproduction highly contributes to recovery of damaged reefs. Because recovery starts right away, there is less chance that substrates will be overgrown by other benthic species (High Smith 1982 uit Brown and Haward)

Gorgonians: The results vary per individual. They usually grow at very fast but some develop a strong base and others don't. Also some grow fast quickly branching and others grow slow and just have two branches. They easily form new branches after breakage.

To monitor an overall impression of the corals is important because growth rates doesn't always give impression of health. Damaged corals need energy for recovery and won't grow as fast while it can be perfectly healthy.

### Details

	# plugs	#dead	%of dead	% ofplugs	% of total
??		1.0	3.4		0.7
Black rod	15	2.0	6.9	13.3	1.3
Finger	27	4.0	13.8	14.8	2.6
Flower	8	1.0	3.4	12.5	0.7
Leaf	24	2.0	6.9	8.3	1.3
Pencil	13	3.0	10.3	23.1	2.0
Staghorn	28	16.0	55.2	57.1	10.5
White rod	11	1.0	3.4	9.1	0.7

Status coral plugs July 3, 2001

In total 19.08 % of the plugs died

Order of % of dead:

Staghorn, Finger, Pencil, Leaf/black rod, white rod/??/flower

Order of % dead of total plugs (placed fragments thus relatively)

Staghorn, Pencil, Finger, Black rod, Flower, White rod, Leaf.

That makes the Staghorn most vulnerable followed by the 2 other branching corals Pencil and Flower. They also have powerful regeneration capability so more careful treatment may give better results.

Leaves condition of maze coral/blushing star coral/ star coral, brain corals, mustard hill coral. There are not enough plugs made of these species so no real conclusions can be drawn.

***Monitoring interval: March-October***

<u>subject</u>	<u># dead</u>	<u>% dead</u>	<u># alive</u>	<u>% alive</u>	<u>Total # plugs</u>	<u>Mortality</u>
total coral plugs	43	28	112	72	155	
Black sea rod	2	15.4	13	84.6	15	low
Blushing star coral	0	0	1	100	1	not enough samples
Brain coral	0	0	5	100	5	possibly low
Finger coral	13	54.2	16	45.8	24	high
Flower coral	1	12.5	7	87.5	8	low
Leaf coral (lettuce)	0	0	25	100	25	very low
Maze coral	1	16.6	5	83.4	6	possibly low
Mustard hill coral	0	0	1	100	1	not enough samples
Pencil coral	8	53.3	7	46.7	15	high
Purple searod	0	0	6	100	6	possibly low
Staghorn coral	17	60.7	11	39.3	28	high
Star coral	0	0	3	100	3	not enough samples
Starlet coral	0	0	2	100	2	not enough samples
White searod	1	9.1	10	90.9	11	low

There is a total survival of 72% which is not so bad after the heavy algae growth from March till about August. Leaf coral (*Agaricia agaricites*) seems to survive best. Even the plugs that were considered dead before "came back" and started to grow again after most of the algae disappeared. The disappearance of the algae went simultaneously with high recruitment of snails (*Cerithium* sp.). Also for other species like *Porites porites* (finger coral), *Acropora cervicornis* (staghorn coral) and *Madracis mirabilis* (pencil coral) a clear outgrow of tissue was observed over the base of the cement plugs were algae were removed. I actually removed lots of the algae manually and after that I believe no new outbreaks of algae occurred and also the snails started to keep the plugs clean. It might be a combination of circumstances of manual removal, disappearance of certain algae and the recruitment of the ceriths that created much better opportunities for the coral plugs.

Although the *Acropora c.* still has the lowest survival rate of 39.3%, most of the plugs that are left over are doing extremely well with many new branches. In 2 cases a tip or branch broke off but the recovery was fast and even more new grow tips developed (like with some plants that you have to prune to make them grow better). These plugs could therefore function as donor colonies for new coral plugs in the future so no fragments have to be taken from the wild. My experience with this species in this project and other is that under no circumstances you should touch this coral with your hands. They seem to be extra vulnerable for contact with human tissues while breakage (quite an impact) doesn't affect them so much.

Also *Porites p.* and *Madracis m.* have a high mortality rate but I have seen no other species trying to recover so hard as these ones. Specially *Porites* suffered a lot from predation, large parts were scraped off but when there was enough tissue left over the tissue grew back very fast. Most plugs that are left

over now start to cover the base of the plug or make new branches. New tissues are whitish si not to be confused with bleaching. Madracis also suffered some predation but because of the small size of the fragments there main problem was the algae. Now the algae are gone at most places, they have the chance to show how well they will do (not certain at this stage yet).

The Montastrea a. is a very strong coral and can withstand a lot of stress. This was mainly observed with the new coral plugs, where grow out over the plug is clearly observe d. Because this species is (like Agaricia a.) a main reef builder it should be used for future plugs in spite of it's slow growth rate.

Agaricia a likes darker spots (not so many algae?). In the beginning lots of algae were growing on the upper surface which died off while the lower surface stayed alive. Specially the smaller fragments had a hard time to fight the algae and it looked as if the weren't going to make it. Now most of the plugs are recovering and specially at the sides with the least amount of direct sunshine the plugs grow best.

The Eusmilia f. plugs grow slowly but surely. They don't seem to be bothered by the algae so much. Probably because they have big polyps.

The gorgonians seemed to do very well in the beginning but now show some problems. Especially some white sea rods show signs of broken tips, dried up tissue and thin branches. Also a few black sea rods show thin branches. It's not sure what the cause is yet and how this will develop.

All brain coral do well. They are fairly strong can stand high stress levels for a short while but again they are slow growing. Other species need more samples to draw any conclusions.

Before the coral spawning (September/October) a few Reef Balls were brushed off to remove excess of algae. In November coral recruits were observed with speci al blue light (since they are fluorescent ) In December they could be observed with the naked eye. All recruits were found on the cleaned Reef Balls and most on the Ultra Ball. There are 2 species observed so far the identification is not clear yet (Madracis and Eusmilia?).

#### **Some statements from literature:**

In studies of Connell (1973) and Bak and Engel (1979) mortality of juvenile corals on reef unaffected by human disturbance is was resp. 36% and 32% during 11 and 6 months study periods. The causes of mortality were sedimentation, competition with coralline algae on shallow reefs and possible random grazing and/or predation by parrot fishes.

Sedimentation: Decreased light values/increased energy consumption and po ssible reduction in planktonic food. (Bak '78)

Bacterial infections are often the result of corals protecting themselves against outside stresses by mucus secretion. This may contribute to increase of the blue green algae that are responsible for the black band disease. That means mucus is a protection but also weakens the coral.

Harold Hudson 1981: Tolerance for transplantation: Montastrea annularis from deeper water to shallow water showed reduced growth rates and severe mortality while transplanting from inshore to off shore showed only slightly reduced growth rates ( increased environmental tolerances).

Bak, R. P. M. (1978). "Lethal and sublethal effects of dredging on reef corals." Mar Pollut Bull 9(1): 14-16.

Bak, R. P. M. and M. S. Engel (1979). "Distribution, abundance, and survival of juvenile hermatypic corals (Scleractinia) and the importance of life history strategies in the parent coral community." Marine Biology 54: 341-352.

Connell, J. H. (1973). Population ecology of reef-building corals. Biology and Geology of Coral Reefs Volume II: Biology 1. O. A. a. R. E. Jones. New York, Academic Press: 205-245.

Hudson, J. H. (1981). "Response of *Montastrea annularis* to environmental change in the Florida Keys." Proc 4th Int Coral Reef Symp, Manila 2: 233-240.