

Example 7.1. Breakdown of costs for a rehabilitation project using *in-situ* modular tray nurseries with capacity to produce 10,000 coral transplants per year.

1. Collection of source material (fragments from donor colonies).

1a. Equipment/consumables needed to collect source material – 10,000 fragments from donor colonies			
Item	Unit cost	Quantity	Total cost
Chisel	\$3.00	2	\$6
Hammer	\$4.00	2	\$8
Baskets	\$1.50	6	\$9
Cutters	\$3.50	2	\$7
Total			US\$30

1b. Labour/diving/boat time needed to collect source material – 10,000 fragments from donor colonies		
Item	Breakdown	Total
Person-hours (#)	2 people x 10 h	20
Air-tanks (#)	2 people x 10 tanks	20
Boat time (days)	6 x half-day trips	3

- Collection of source material may become more costly per fragment as numbers are scaled up because of the need to go further afield to find either corals of opportunity or donor colonies.

2. Setting up *in situ* modular tray nursery facilities

2a. Equipment/consumables needed to construct c. 10,000 fragment tray nursery			
Item	Unit cost	Quantity	Total cost
PVC pipes, PVC connectors and PVC glue			\$725
Plastic mesh			\$70
Cable-ties			\$140
Ropes			\$75
Buoys			\$380
Metal stakes (angle iron)			\$75
Cement			\$15
Miscellaneous			\$170
Total			US\$1650

2b. Labour/diving/boat time needed to construct c. 10,000 fragment tray nursery		
Item	Breakdown	Total
Person-hours (#)	Land: 2 people x 10 days x 10 h	200
	Modular trays: 2 people x 5 days x 7 h	70
	Installing ropes and buoys: 2 people x 3 days x 10 h	60
	Nursery deployment: 4 people x 3 days x 4 h	48
	Total	378
Air-tanks (#)	54 tanks for deployment and rope/buoy installation	54
Boat time (days)	3 full-days nursery deployment and 3 full-days installing ropes and buoys	6

3. Establishing collected material in culture/nurseries.

3a. Equipment/consumables needed to establish c. 10,000 fragments in a tray nursery			
Item	Unit cost	Quantity	Total cost
Cutters	\$3.50	2	\$7
Plastic containers (50 l)	\$10	4	\$40
Cyanoacrylate glue	\$1.50	50	\$75

Substrate for fragments (68 m plastic pipe for branching species; 9 x 22 m (198 m ²) plastic mesh for submassive)			\$20
Total			US\$142

3b. Labour/diving/boat time needed to establish c. 10,000 fragments in a tray nursery		
Item	Breakdown	Total
Person-hours (#)	4 people x 7 h x 63 days (Transplanting corals on trays and deploying in nursery)	1764
Air-tanks (#)	2 tanks per person (4) per day (63)	504
Boat time (days)	63 full-days of boat	63

- Average time to glue and transplant coral to tray = 1.5 min (250 hours for 10,000)

4. Maintenance of material in culture.

4a. Equipment/consumables needed to maintain c. 10,000 fragment tray nursery for one year			
Item	Unit cost	Quantity	Total cost
Brushes	\$1	2	\$2
Gloves	\$1	2	\$2
Spare buoys			\$67
Rope			\$5
Cable ties			\$33
Total			US\$109

4b. Labour/diving/boat time needed to maintain c. 10,000 fragment tray nursery for one year		
Item	Breakdown	Total
Person-hours (#)	2 people x 6 h = 5 x per month	720
Air-tanks (#)	4 tanks per visit (5 times per month)	240
Boat time (days)	1 full-day trip per visit (5 times per month)	60

- Estimates range from 2 people x 6 h x 4 times/month (576 person-hours) to 2400 person-hours. An intermediate estimate is that modular table nurseries are cleaned twice a month for 2-3 days (4-6 days/month) by two or more divers with 6-7 h per day spent cleaning the nurseries (no scientific monitoring included). The latter suggests at least 720 person-hours per year.
- The amount of maintenance needed may vary by a factor of 3 or even more from site to site depending on local water quality, abundance of herbivores to keep algae in check and abundance of predators of pests (e.g. fish that eat young *Drupella*). There was heavy fishing pressure at the example site, thus herbivorous and predatory fish were rare. The nearest aquaculture ponds and sources of nutrient rich run-off were about 3 km away from the nursery site. Estimated maintenance effort quoted here might be doubled or halved depending on the water quality at your proposed site.

5. Transfer and attachment of material from *in-situ* modular tray nursery to the restoration site.

5a. Equipment/consumables needed for transport of c. 10,000 fragments and attachment at restoration site (based on data for 1,000)			
Item	Unit cost	Quantity	Total cost
Baskets	\$1	5	\$5
Plastic containers	\$3.50	10	\$35
Total (transport)			\$40
Nails			\$250
Hammers			\$15
Epoxy putty			\$500
Wire brushes			\$10

Total (attachment)			\$775
Total			US\$815

5b. Labour/diving/boat time needed for cleaning/transport of c. 10,000 fragments and attachment at restoration site (based on data for 1,000)		
Item	Breakdown	Total
Person-hours (#)	Cleaning/transport – 4 people x 2 h per day x 100 days	800
	Attachment – 4 people x 6 h per day x 100 days	2400
	Total	3200
Air-tanks (#)	Cleaning/transport – 4 tanks per day x 100 days	400
	Attachment – 8 tanks per day x 100 days	800
	Total	1200
Boat time (days)	Transport and attachment – 1 full-day trip for 100 days	100
	Total	100

- “Cleaning” involved removal of algae and sessile invertebrates from coral rearing substrates and removal of corallivorous gastropods from corals.
- Costs have been scaled up from those for 1000 colonies. In the example relatively small boats (capacity ~200 colonies) transported colonies up to 4 km to rehabilitation sites. Costs of this step will be dependent on distance from nursery to rehabilitation site and boat capacity in terms of numbers of transplants that can be carried per trip.

6. Maintenance and monitoring of transplants at restoration site.

6a. Equipment/consumables needed to maintain/monitor 10,000 transplants			
Item	Unit cost	Quantity	Total cost
No additional equipment needed			0
Total			US\$0

6b. Labour/diving/boat time needed to maintain/monitor 10,000 transplants		
Item	Breakdown	Total
Person-hours (#)	Maintenance visits 12 times per year: 2 people full-day visit (8 h)	192
Air-tanks (#)	Maintenance check 12 times per year (8 tanks per survey – 4 per person)	96
Boat time (days)	Maintenance check visits: 12 full-day trips	12

- Figures above, for maintenance at transplant site, are estimates. The resources allocated allow some time for adaptive management in the event of problems being identified (e.g. COT or *Drupella* infestations) and assume little maintenance of transplants (e.g. macroalgae removal) is needed.