



Global Re-introduction Perspectives: 2013

Further case-studies from around the globe
Edited by Pritpal S. Soorae



IUCN/SSC Re-introduction Specialist Group (RSG)





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Published by: IUCN/SSC Re-introduction Specialist Group & Environment Agency-ABU DHABI

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Citation: Soorae, P. S. (ed.) (2013). *Global Re-introduction Perspectives: 2013. Further case studies from around the globe*. Gland, Switzerland: IUCN/SSC Re-introduction Specialist Group and Abu Dhabi, UAE: Environment Agency-Abu Dhabi. xiv + 282 pp.

ISBN: 978-2-8317-1633-6

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Rhizophora mucronata an extinct mangrove species re-introduced to Ras Ghanada Island, Abu Dhabi, United Arab Emirates after 100 years

Najamuddin Vistro*

Mangrove Project Manager, Barari Forest Management, P. O. Box 113260,
Abu Dhabi, UAE najamuddin_vistro@barari.ae
(*Formerly Scientist, Mangrove Ecology in Environment Agency-ABU DHABI
from 2000 - 2004)

Introduction

Mangroves are one of the most important ecosystems of UAE both ecologically and economically. They support a complex aquatic food web and provide a unique habitat for a variety of bird, marine fauna and have a high aesthetic value for developing eco-tourism. Mangroves are most important spawning areas for fish and shellfish. The presence of mangroves, act as a stabilization force to protect coastline from the devastations of cyclones. *Avicennia marina* is the only native mangrove species growing in the UAE. Historical records suggest that another mangrove species, *Rhizophora mucronata*, once grew here. Due to various unknown reasons, this mangrove species became extinct about 100 years ago. *R. mucronata* is included in the "IUCN Red List of Threatened Species" as a native mangrove of UAE.

During the year 2001, Department of the President Affairs, Abu Dhabi (formerly Crown Prince, Private Management Abu Dhabi) and Environment Agency Abu Dhabi (EAD) initiated a joint comprehensive research and development program to revive back *R. mucronata*; an extinct natural heritage mangrove species of the country at Ras Ghanada Island. Keeping in view the similarity of climatic conditions, propagules of *R. mucronata* were procured from Pakistan. In the first phase, various nursery research studies on survival and growth of seedlings were conducted. In the second phase, experimental field plantations were established at Ras Ghanada Island. The plantations were established in complete natural coastal



Rhizophora mucronata plantation

environment at a Sand Hill site to evaluate the survival and growth potential of the species in the natural habitat. First monitoring and evaluation of plantations was done after five years of planting in July 2008. It was amazing to observe that out of 350 seedlings planted, 280 plants (80%) were surviving and transformed in to a beautiful plantation. The second monitoring and evaluation was done in October 2011 after an



Rhizophora mucronata seedlings

interval of three years of first monitoring and eight years after planting. It was observed that after three years, there was a 50% survival rate. However, remaining surviving plants look very healthy with dark green foliage and produced a typical prop root system. This is an indication that the surviving *R. mucronata* plants have fully adapted local site and environmental conditions and became part of ecosystems.

Goals

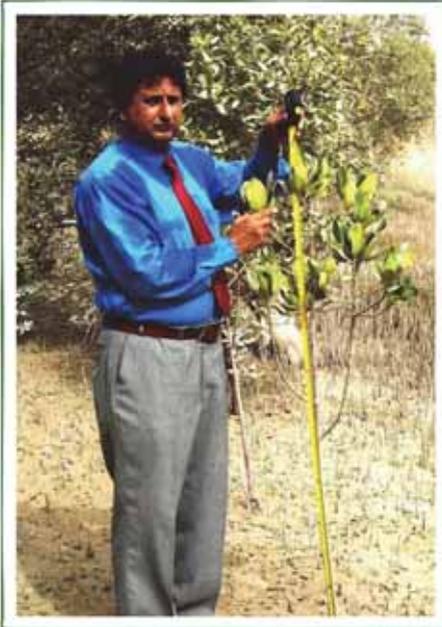
- Goal 1: Re-introduce *R. mucronata* back to Arabian Gulf waters of Abu Dhabi, UAE.
- Goal 2: Standardize appropriate nursery techniques through research and development studies for growing seedlings in the nursery.
- Goal 3: Standardize plantation techniques for establishing successful plantations.
- Goal 4: Increase biodiversity of mangrove species in the UAE.
- Goal 5: Prepare manual/guidelines for establishment of *R. mucronata* container plants nurseries and plantations in the UAE.

Success indicators

- Indicator 1: Grow healthy *R. mucronata* seedlings in the nursery.
- Indicator 2: Establish successful *R. mucronata* plantations.
- Indicator 3: Publish manual for raising mangrove container plants nurseries and mangrove plantations in the UAE.

Project summary

Feasibility: In the year 2001, “Department of the President Affairs, Abu Dhabi” (formerly Crown Prince, Private Management Abu Dhabi) and EAD started a joint venture “Mangrove Research and Development Project” to re-introduce *R. mucronata*; one of the extinct mangrove species of the Arabian Gulf



Author measuring *Rhizophora mucronata* plants

back to the coastal waters of Abu Dhabi, UAE. All the logistic, manpower and other required facilities were provided by the Department of President Affairs, Abu Dhabi. EAD provided technical expertise and arranged propagules collection and import from Pakistan.

A comprehensive research and development program focusing on development of appropriate nursery & plantation techniques was started under the supervision and guidance of the Author as follows:

- Survival and growth of seedlings in the nursery.
 - Use of appropriate soil media for optimum seedling growth.
 - Effect of water salinity on seedling survival, growth and physiology.
 - Effect of shade on the survival and growth of seedlings.
 - Use of an appropriate pot size for optimal growth of seedlings.
- Survival and growth studies on establishment of plantations.

After successful growing of *R. mucronata* seedlings in the nursery, experimental field plantations were established at selected sites during the year 2002 - 2003.

Implementation: There were three major components of the *R. mucronata* re-introduction project i) procurement of propagules from Pakistan, ii) growing sufficient number of quality seedlings in the nursery, and iii) establishment of experimental plantations. Mature *R. mucronata* propagules were procured from Dam Forest block of Baluchistan province, Pakistan with the assistance and cooperation of Sindh Forestry Department, Karachi, Pakistan and WWF, Karachi, Pakistan. A new nursery section was reserved in a screened shade-house with natural sunlight and without temperature control for conducting nursery research trials and growing container plants. The Photo-synthetically Active Radiation (PAR) inside the screened shade-house was about one-fifth of direct PAR. The fresh propagules flown from Pakistan were immediately planted in the plastic pots measuring 12.5 cm x 11.5 cm in the nursery. The propagules were watered twice a day with a mixture of seawater and freshwater in 50:50 ratio for the first two weeks. Afterwards, seedlings were watered once a day in morning time with 100% seawater.

Experimental plantations were established during the year 2003 at the Sand Hill site near the intertidal water channel with clay loam substratum. Scattered patches of young natural *A. marina* were present along the western portion of the

plantation site. Eastern portion was blank without any plant growth. This was an ideal site for comparing the survival and growth behavior of *R. mucronata* on blank area and in association with *A. marina*. The selected area for planting was carefully demarcated by fixing demarcation rods on the outer boundaries. Before shifting the plants from the nursery to planting site, each plant was evaluated. Only, healthy seedlings having 50 cm height and above were selected for planting. The plantation operations were carried out during the low tide period in the day time. The location of each plant was demarcated on the site. The labor was provided adequate training on handling and planting seedlings before start of plantation operations. 350 *R. mucronata* seedlings were planted in a square shape at 3 m x 3 m spacing.

Post-planting monitoring:

Nursery: In the nursery, seedling emergence from the propagules started from the 7th day of planting and continued up to 22nd week. The seedling emergence was faster (84%) during the first 12 weeks. The seedlings attained an average height of 60 cm with mean leaf size of 42.69 cm² in 22 weeks.

Plantations: After 2004, no monitoring and further rehabilitation/plantation work was carried out. The first monitoring and evaluation was done in June, 2008. It was observed that out of 350 seedlings planted, 280 plants (80%) were surviving and transformed in to a beautiful plantation. Press releases of this success story were issued by the Director of the Department of the President's Affairs and were published in various Arabic and English newspapers highlighting re-introduction of *Rhizophora mucronata* after 100 years.

The second monitoring and evaluation was done in September, 2011 after three years interval. Survival and height growth data are shown in Table 1.

Year	Surviving Plants	Average Height	Maximum Height
2008	280	1.30 m	1.70 m
2011	140	1.50 m	2.02 m

Although, during the 2008 to 2011 period, 140 (50 %) plants had died but the remaining surviving plants were very healthy. It is interesting to observe that "*R. mucronata* plants have adapted the local site conditions and are growing in the natural environment side by side with natural *A. marina*. It is interesting to observe that *A. marina*, is acting as a barrier, by protecting *R. mucronata* plants from gazelles, hot dusty winds and barnacles. The plants have attained 1.50 m - 2.02 m height. The plantations are presenting an eye catching scene of a mixed mangrove forest and a classical example of mangrove biodiversity. "These are the unique plantations of *R. mucronata* in the UAE growing only at Ras Ghanada Island".

Major difficulties faced

- Procurement of propagules from Pakistan.
- Harsh summer temperatures with dusty winds.
- Grazing pressure by gazelles.
- Presence of barnacles.

Major lessons learned

- Site selection for *R. mucronata* plantations is most critical. Survival and growth of plants depends on proper site selection.
- Predominantly bare sandy soils should not be selected for plantations.
- Plantations should not be established on low tidal mud flats.
- Healthy and appropriate sized planting stock is one of the major factors for success of mangrove rehabilitation/plantation program.
- Best planting season is November - December.
- Protection of young plants against gazelles is most important. Gazelles like to eat fleshy green leaves and also de-bark the stem by scratching with their horns and head.
- Survival rate is more when planted within the natural young stands of *A. marina*.
- *A. marina* is performing as a “motherly role” and protecting *R. mucronata* plants from gazelles, hot dusty winds and barnacles.

Success of Project

Highly Successful	Successful	Partially Successful	Failure
		√	

Reason(s) for success/failure:

- Conducting comprehensive research to standardize nursery and plantation techniques.
- Selection of most suitable plantation sites.
- Selection of healthy and proper sized planting stock.
- Planting operations at proper time and proper planting season.
- Care in handling and transportation of plants from nursery to plantation sites.
- Planting within the natural *A. marina* young stands.
- Effective technical guidance and supervision.

Acknowledgements: The author gratefully acknowledge the Department of President Affairs, Abu Dhabi, UAE for providing facilities and assistance in establishing and maintaining *R. mucronata* nursery and plantations at Ras Ghanada Island.