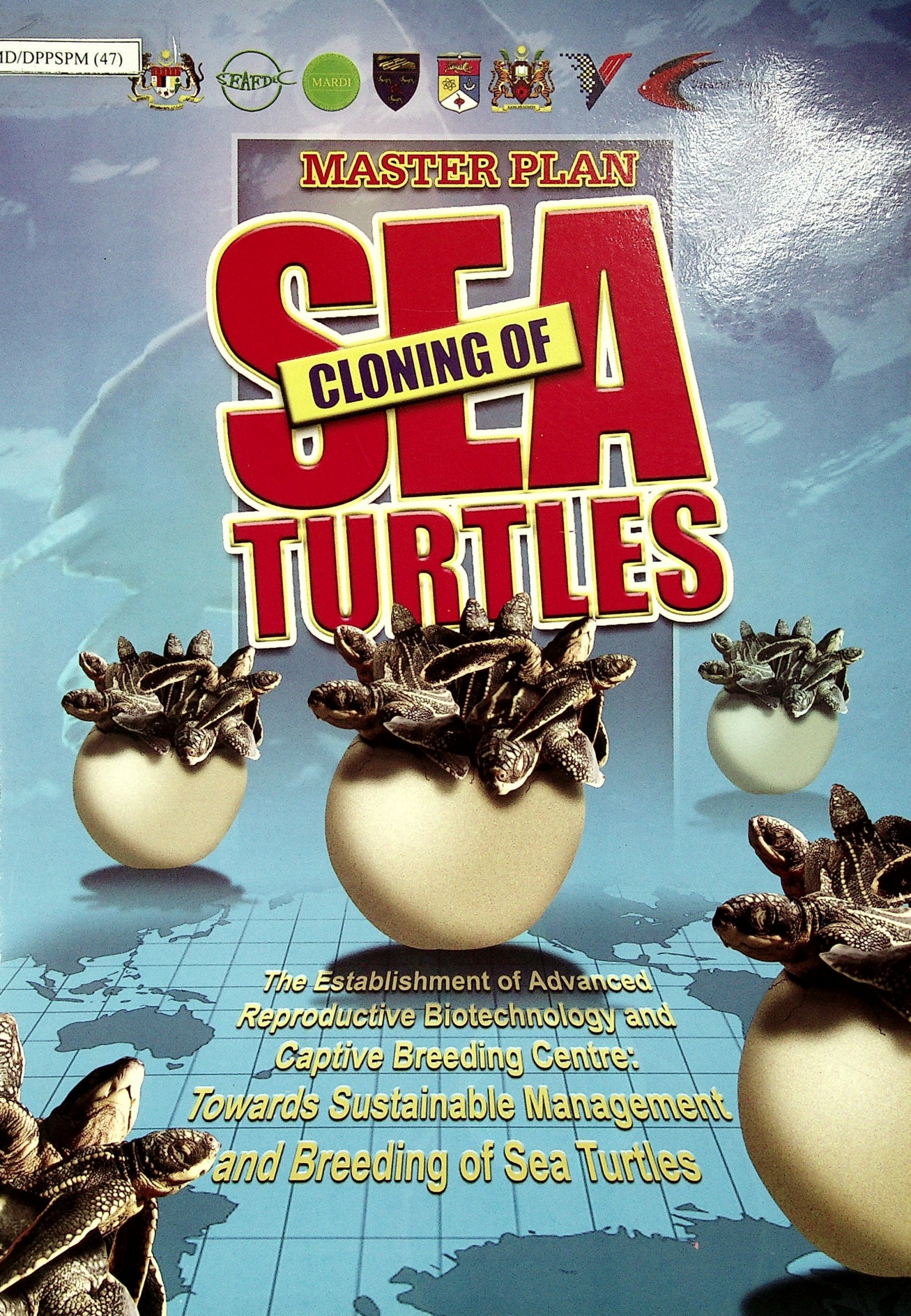
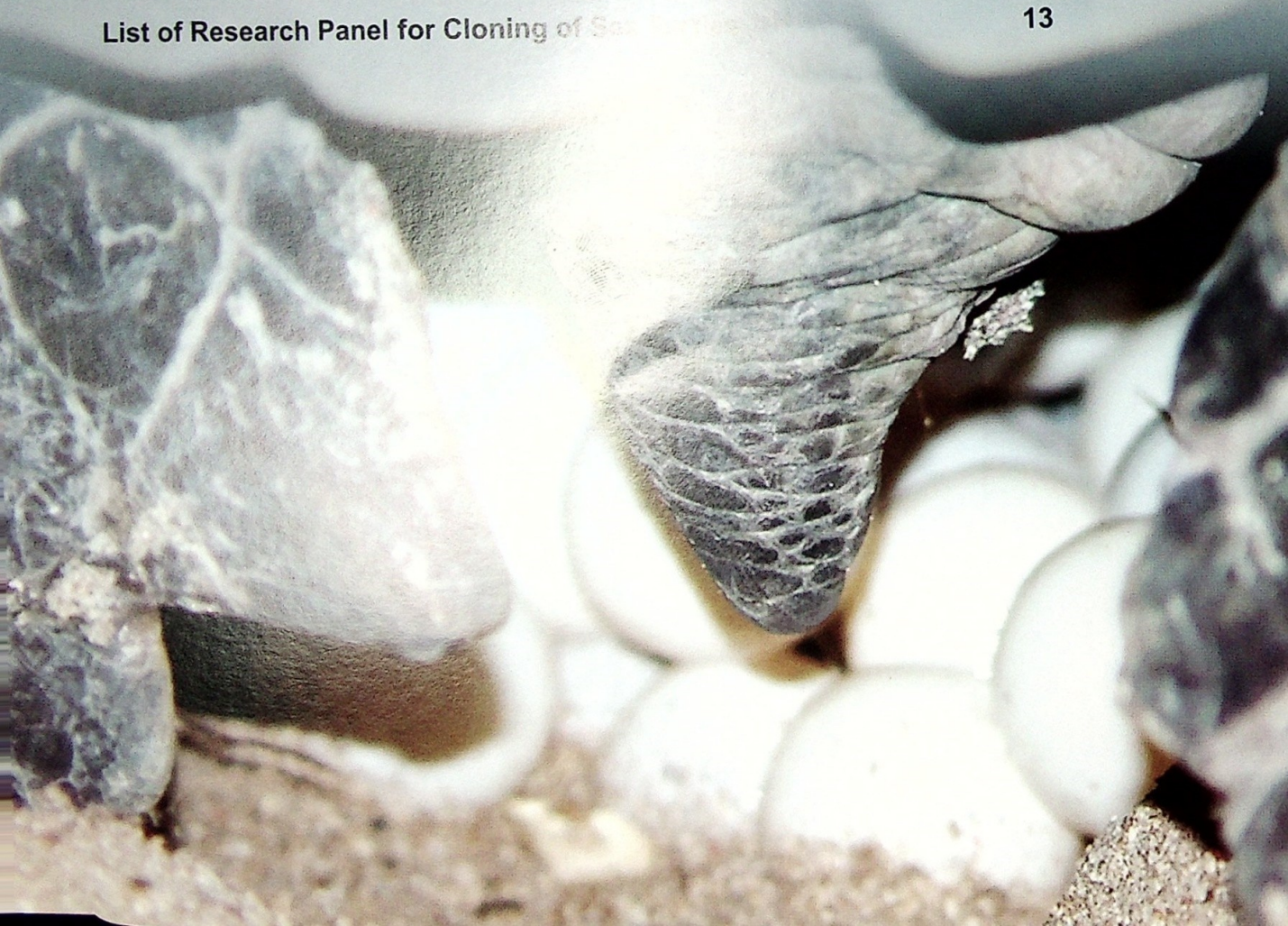
MASTER PLAN

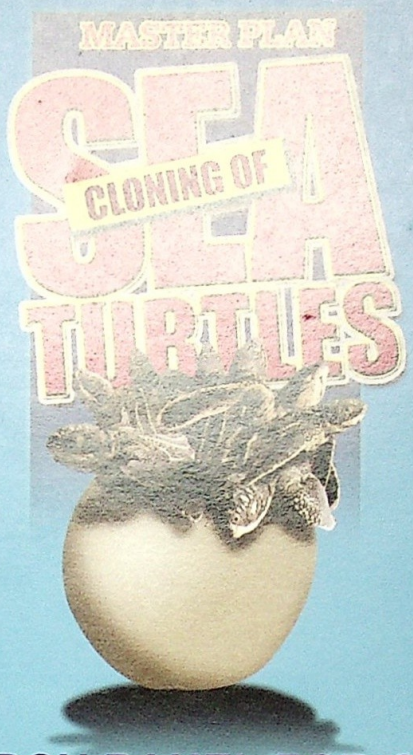
CLONING OF SEA TURTLES



The Establishment of Advanced Reproductive Biotechnology and Captive Breeding Centre: Towards Sustainable Management and Breeding of Sea Turtles

CONTENTS





RESEARCH PANEL FOR CLONING OF SEA TURTLES

Dato' Junaidi bin Che Ayub

Y.M. Raja Mohammad Noordin bin Raja Omar

Mr. Kamarruddin bin Ibrahim

Dr. Abas Mazni bin Othman

Dr. Roosevien Farida bt. Rachmat

Dr. Shaharum bin Shamsuddin

Prof. Dr. Rahmah bt. Mohamed

Prof. Dr. Ramli bin Abdullah

Tuan Syed Abdullah bin Syed Abdul Kadir

Mr. Zulkifli bin Talib

Ms. Wahidah bt. Mohd. Arshaad

Dr. Khairina bt. Tajul Arifin

Project Summary

1. BACKGROUND

Malaysian is known worldwide as one of the main spots for landing and nesting of four of the seven sea turtles in the world. These species are the Leatherback, Green, Hawksbill and Olive Ridley turtles. Rantau Abang is still considered as one of the main location for the landing of Leatherback turtles in the Southeast Asia and Asia Pacific Regions. Various approaches in management, conservation and research of sea turtles have been undertaken in the early 70s by Malaysian researchers. Various research activities have been undertaken in the fields of hatchery management, tagging, satellite tracking and studies on causes of sea turtle mortality. Thus in the Southeast Asian region, Malaysia has been recognized as the leader in the management and conservation as well as research of sea turtles.

In the 90s the Department of Fisheries has established the Marine Fishery Resources Development and Management Department (MFRDMD) and the Turtle and Marine Ecosystem Centre (TUMEC). Through a regional intergovernmental treaty in 1967, the Southeast Asian Fisheries Development Center (SEAFDEC) was established to develop the fishing industry in the region. To date there are four Turtle Information Centres (TIC) with hatcheries located at Pengkalan Balak, Malacca; Cherating, Pahang; Segari, Perak and Rantau Abang, Terengganu. In addition, several rookeries are located at Pantai Kerachut, Penang; Pulau Tinggi, Johor; Ma' Daerah, Mak Kepit, Pulau Perhentian, Paka, Geliga and Chagar Hutang, all in Terengganu.

Photo by **TUMEC**

In the last decade, there is a significant reduction in the reported turtle landings on the beaches of Peninsular Malaysia. The major concern is that the Leatherback turtle landings in Rantau Abang have reached an alarming level. The statistics for 2005 has showed only a single occurrence of Leatherback turtle landing. On the other hand, all eggs laid between 1999 to 2005 by the Leatherback turtles at Rantau Abang failed to hatch.

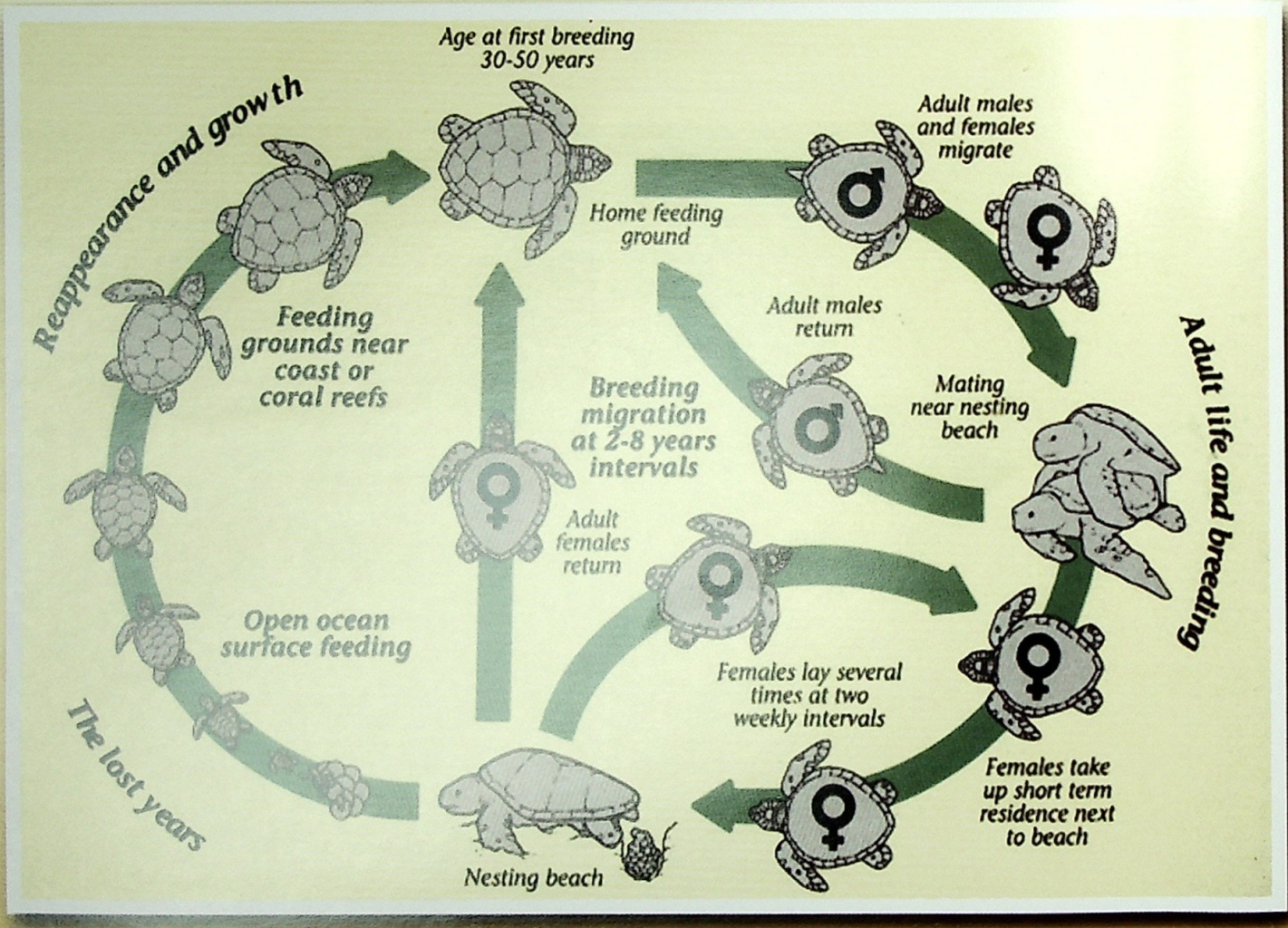
If this trend continues, there is a possibility that in the future, Rantau Abang would become a distant memory as one of the places for the Leatherback turtle landing in the world. Thus the world would consider all the management and conservation efforts of current local and international scientists and non-governmental organizations have not reached its desired outcome. Therefore Malaysia's effort and credibility in the management, conservation, and research of sea turtles in the Southeast Asia is compromised.

As a leading country in turtle management and conservation, it is imperative that Malaysian scientists and managers demonstrate their ability to explore new research avenues and management strategies to increase the number of Leatherback turtle population. New approaches utilizing Advanced Reproductive Biotechnology (ARB), captive breeding and genomics need to be implemented. An integrated programme of sea turtle breeding, management together with commercialization efforts would pave way for future sustainability of the nation's bio-resource.

2. OBJECTIVE

The overall objective of the project is the creation of a national centre of excellence with the state-of-the-art environment and facilities that can act as a powerhouse for captive breeding, multiplication and commercialization of technologies and products of sea turtle research.

Thus this project will put in place an infrastructure for sustainable captive breeding program of sea turtles through the development and application of Advanced Reproductive Biotechnology as well as the use of genomics as a tool for fundamental research and gene discovery in sea turtle.



Sources: **Biology of Sea Turtles Vol. 1**

The broad specific objectives are:

- To establish Advanced Reproductive Biotechnology Centre.
- To apply Advanced Reproductive Biotechnology and genomics in sea turtles research.
- To multiply sea turtles through captive breeding.
- To pursue excellence in scientific discovery and technology development in sea turtle breeding.
- To provide capital-intensive research facilities in sea turtle captive breeding.
- To develop human capital and expertise in sea turtle breeding and management.
- To commercialize products and technologies developed from the sea turtle research.

3. PROJECT COMPONENTS

The major components of this project are:

- The establishment of state-of-the-art infrastructure and facilities
- Continuous recruitment and retooling of research personnel
- Manpower training in Advanced Reproductive Biotechnology, genomics and breeding of sea turtles.

Research areas and projects of the Centre include:

- Sea turtle reproductive biology such as sperm collection and cryopreservation
- Egg fertility studies
- Sex determination and selection
- Cytogenetics, turtle wellness (encompassing turtle medicine and nutrition)
- Functional genomics and genome profiling to unravel the reproductive biology process, management, conservation and commercialization potential of sea turtle

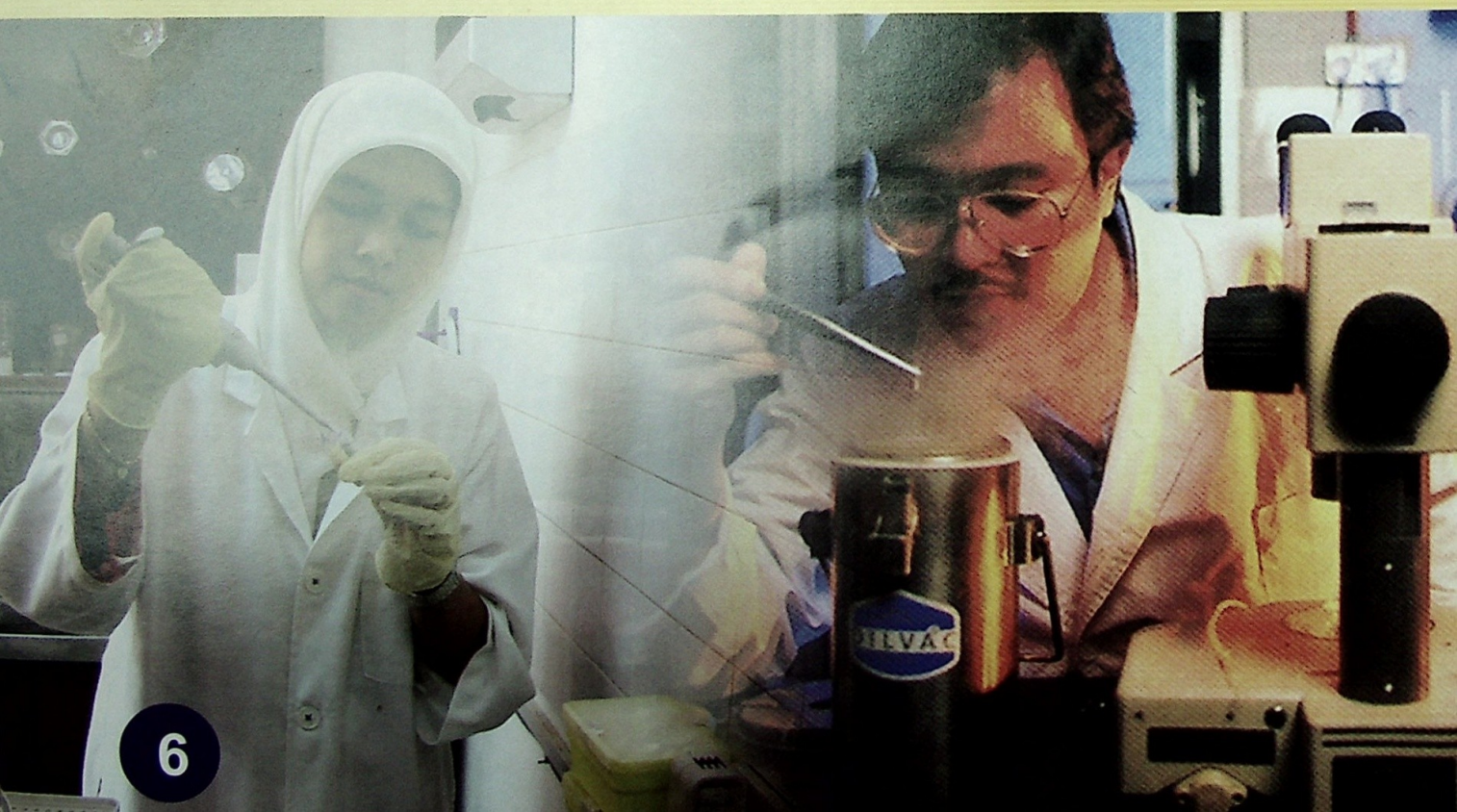
4. COST ESTIMATION

The major cost components are:

- Infrastructure
- Research facilities
- Research grants
- Operational costs

The Centre will have three major state-of-the-art facilities divided in three divisions:

- Captive Breeding Division
- Advanced Reproductive Biotechnology Division
- Molecular Analysis Division

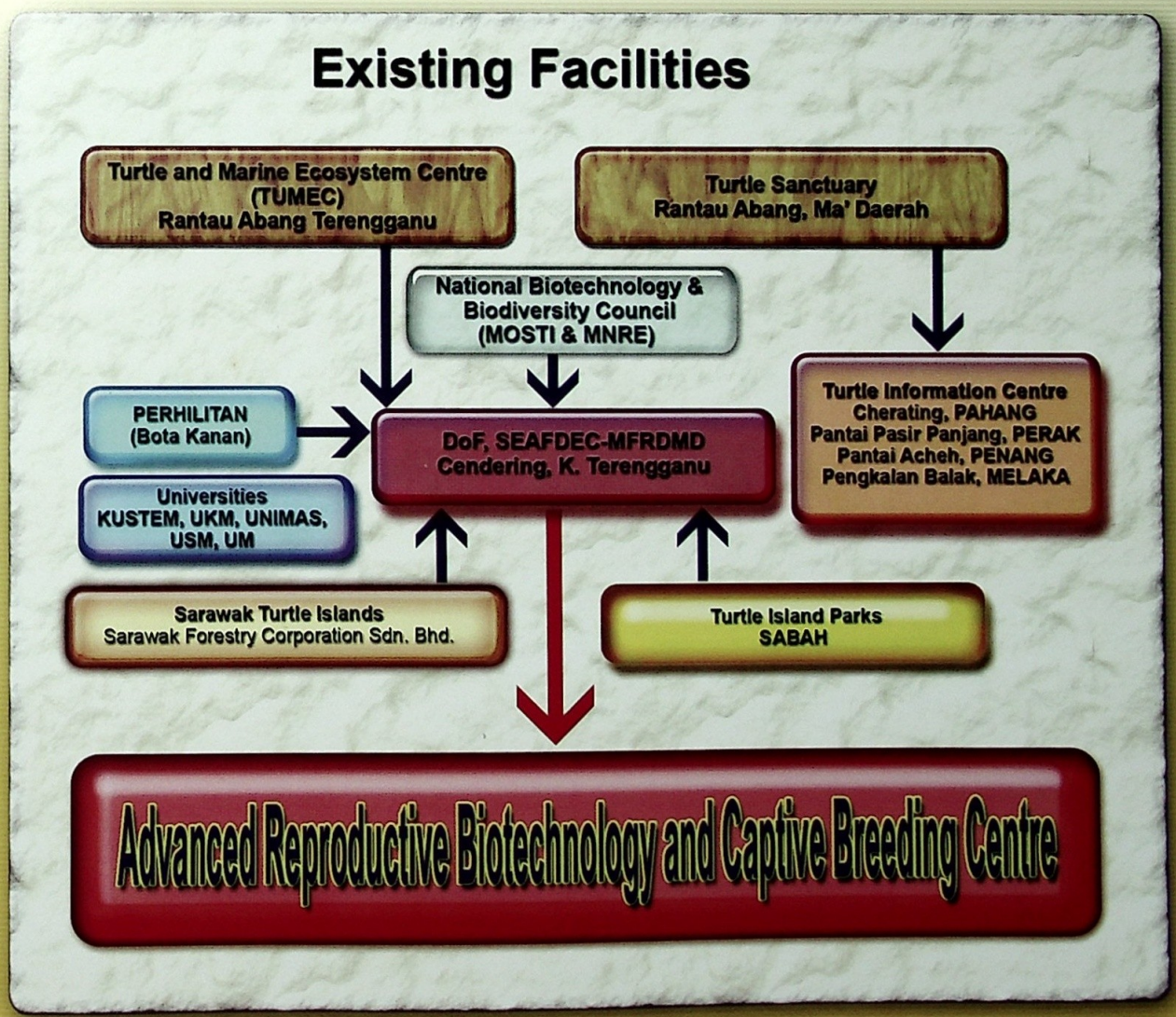


In addition, the Centre will also cater for ecotourism activities.

Year	2007	2008	2009	2010	2011	Total RM
Cost Estimate	10.2	9.2	7.0	4.7	1.7	32.8 Million

The amount of estimation in the above table is only an approximate figure and not ultimate.

Prior to completion of the new infrastructure, research activities will be initiated in the current research facilities at the Turtle and Marine Ecosystem Centre (TUMEC), Rantau Abang and in laboratories in Universiti Malaya, Universiti Kebangsaan Malaysia and Universiti Sains Malaysia, and collaborative Research Institutions such as Malaysia Genome Institute (MGI), Regional Veterinary Laboratories (Kuantan), Malaysia Agriculture Research and Development Institute (MARDI), National Agrotech Institute (NAI), Sarawak Forestry Corporation, Sabah Parks and Wild Life Department (PERHILITAN).



5. CURRENT RESEARCH STATUS

The local scientific community at national and international level are fully aware of the current scenario in the significant depletion of sea turtle population and the urgent need to put in place a sustainable programme of sea turtle breeding and management. In Malaysia, there are already a number of projects in conventional sea turtle conservation, some of which are listed below:

- Turtle population and migration biology-Tagging and satellite tracking
- Hatchery management
- Population genetics
- Headstarting
- Multiple paternity testing

Most of the above projects use general conservation approaches. In addition to provide aid to answer conservation issues, these projects have developed expertise and know-how in turtle conservation management. However, the scale is rather limited.

Photo by **TUMEC**

6. OUTPUT AND EXPECTED BENEFITS

The specific outputs expected from the Centre's research and other programmes can be catogerised as the followings:

- Increase in sea turtle hatching and survival rates
- Successful rearing of sea turtle in captivity
- Improved breeding and multiplication
- New technologies in sea turtle research reproductive biology
- Human resource development
- New approaches in sea turtle management and conservation
- Intellectual properties (instrumentation, bioproducts, genomic information databases, patents on new gene(s), licensing of new processes and technologies)
- Commercialization of products and technologies
- Development of eco-edutourism industry focusing on sea turtles
- New knowledge (scientific publications/newsletter/website)

In addition to direct benefits (such as recognition as the international centre of excellence, gaining royalties from new technologies and intellectual properties), the other outputs are also expected to benefit the country in the relevant spheres such as the scientific community and the eco-edutourism industry. The income generated through eco-edutourism industry will generate new investment in other sphere of the economic value chain, therefore creating additional new jobs for the locals.

7. JUSTIFICATION

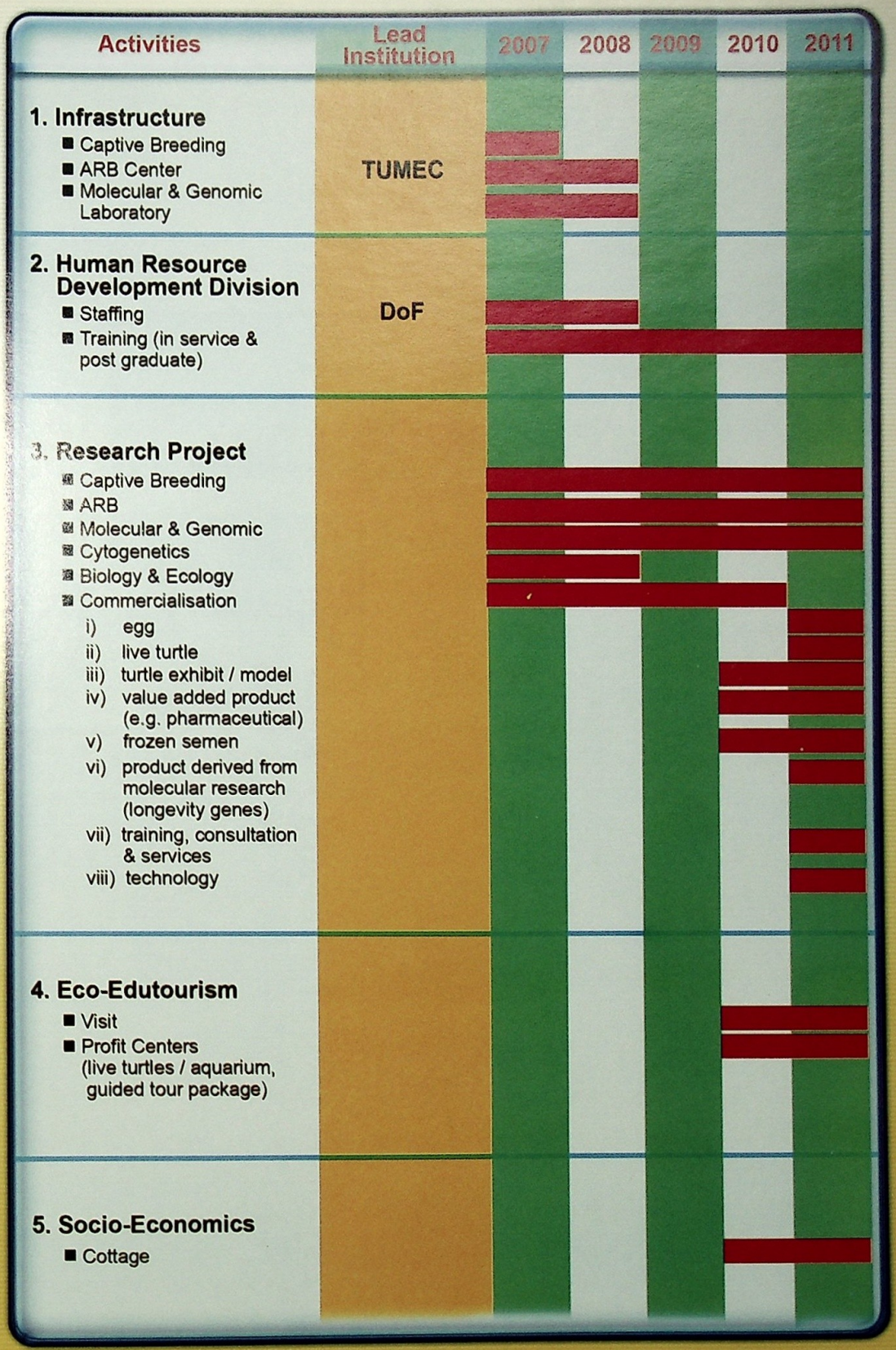
For the past decades the poor management of sea turtles, destruction of habitat and poaching activities have contributed to the drastic depletion of sea turtle populations worldwide.

The establishment of the proposed Centre can be the best option for sustainable management and breeding of the sea turtles. On the other hand, all research activities in the areas of Advanced Reproductive Biotechnology, captive breeding and genomics will definitely provide solutions to the stated problems.

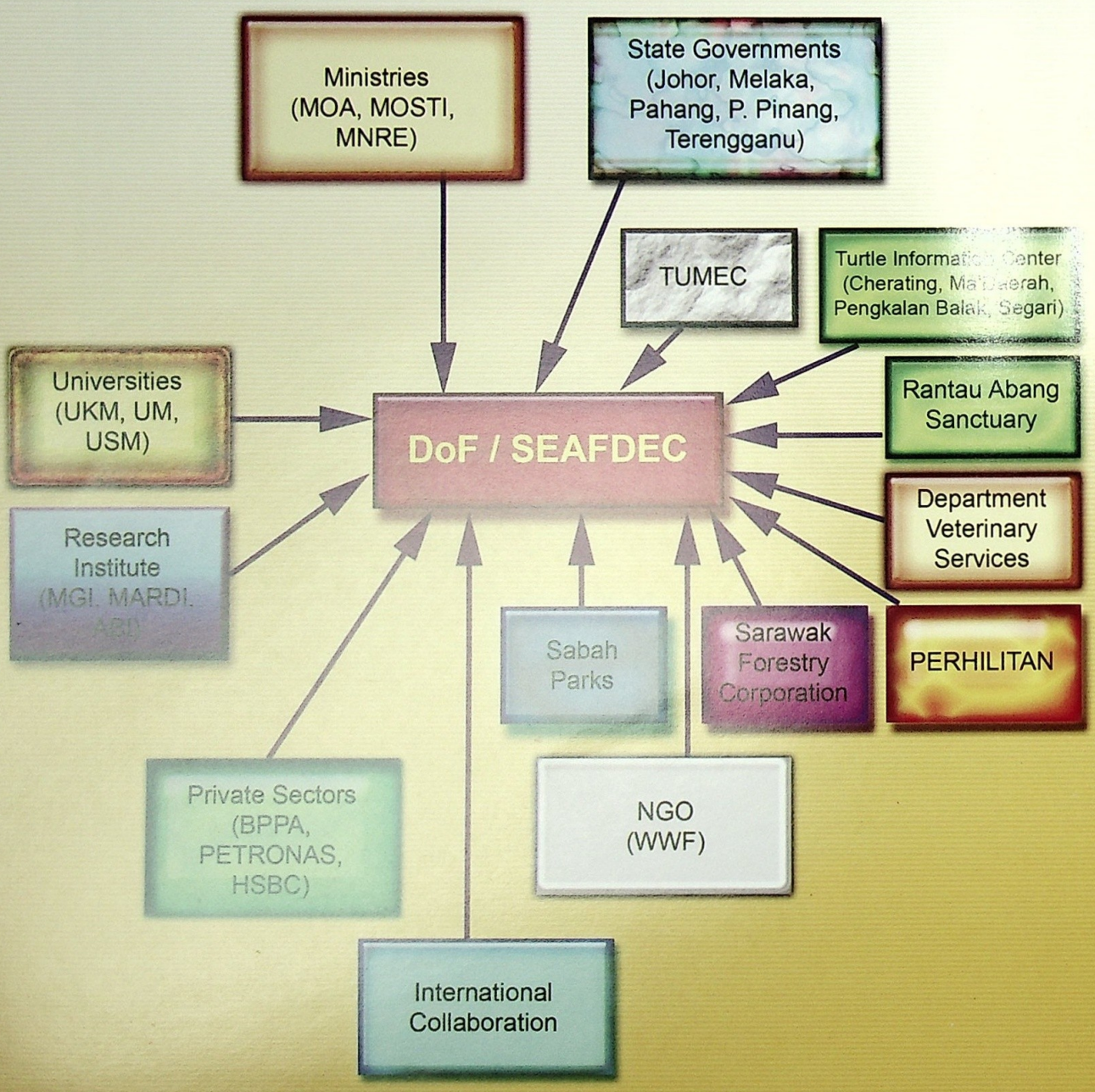
The outputs will generate new industries such as eco-edutourism, support cottage industries as well as creating new jobs to the community. It will also contribute towards the expansion of the k-economy, in which the commodities generated such as bioproducts and technologies/processes from the research can be patented and commercialised. Turtles and related products produced from captive breeding can be marketed to zoos, aquariums, marine parks and related industries.

Photo by **TUMEC**

PROJECT ACTIVITIES



LINKAGES OF THE AGENCIES ON RESEARCH IMPLEMENTATION FOR THE CLONING OF SEA TURTLES



LIST OF THE RESEARCH PANEL FOR CLONING OF SEA TURTLES

1. Dato' Junaidi bin Che Ayub
Ketua Pengarah Perikanan Malaysia
Ibu Pejabat Perikanan, Aras 1-7, Menara Blok 4G2, Wisma Tani, Presint 4,
Pusat Pentadbiran Kerajaan Persekutuan, 62628 Putrajaya.

2. Y.M. Raja Mohammad Noordin bin Raja Omar
Departmen Penyelidikan dan Pengurusan Sumber Perikanan Marin
Taman Perikanan Chendering, 21080 Chendering, Kuala Terengganu

3. Tuan Syed Abdullah bin Syed Abdul Kadir
Departmen Penyelidikan dan Pengurusan Sumber Perikanan Marin
Taman Perikanan Chendering, 21080 Chendering, Kuala Terengganu

4. Ms. Wahidah bt. Mohd. Arshaad
Departmen Penyelidikan dan Pengurusan Sumber Perikanan Marin
Taman Perikanan Chendering, 21080 Chendering, Kuala Terengganu

5. Mr. Zulkifli bin Talib
Departmen Penyelidikan dan Pengurusan Sumber Perikanan Marin
Taman Perikanan Chendering, 21080 Chendering, Kuala Terengganu

6. Mr. Kamarruddin bin Ibrahim
Pusat Penyu dan Ekosistem Marin (*TUMEC*), Rantau Abang, 23000 Dungun,
Terengganu Darul Iman.

7. Prof. Dr. Rahmah bt. Mohamed
Institut Genomik Malaysia, Pusat Teknologi Pintar UKM-MTDC ,
Universiti Kebangsaan Malaysia (UKM) 43600 Bangi, Selangor Darul Ehsan

8. Prof. Dr. Ramli bin Abdullah
Institut Sains Bio-Kesihatan, Fakulti Sains, Universiti Malaya, 50603 Kuala Lumpur.

9. Dr. Shaharum bin Shamsuddin
Pusat Pengajian Sains Kesihatan, Kampus Kesihatan USM, 16150 Kubang Kerian,
Kelantan Darul Naim.

10. Dr. Khairina bt. Tajul Arifin
Fakulti Sains dan Teknologi, Universiti Kebangsaan Malaysia (UKM), 43600 Bangi,
Selangor Darul Ehsan.

11. Dr. Abas Mazni bin Othman
Program Biologi Molekul dan Kejuruteraan Genetik, Pusat Penyelidikan Bioteknologi,
Institut Penyelidikan dan Kemajuan Pertanian Malaysia (MARDI),
43400 Serdang, Selangor Darul Ehsan.

12. Dr. Roosevien Farida bt. Rachmat
Makmal Veterinar Kawasan Kuantan, Jalan Sri Kemunting 2, 25100 Kuantan, Pahang Darul Makmur.

Departmen Penyelidikan dan Pengurusan Sumber Perikanan Marin
Taman Perikanan Chendering,21080 Kuala Terengganu,Malaysia.
Tel: 609-6175940, 6171543, 6177867 Fax: 609-6175136
email: mfrdmd@mfrdmd.org.my

Design: Tolahah