ARTIFICIAL REEFS IN MALAYSIA

The Malaysian Nature Society’s mission is to promote the study, appreciation, conservation and protection of Malaysia’s natural heritage, focusing on biological diversity and sustainable development.

Executive Summary

Artificial reefs in Malaysia provide a number of intended uses. Various types of materials and contraptions have been used in the establishment of artificial reefs areas. In Malaysia, these structures had been placed in both non-protected and protected marine areas.

Deployment of artificial reefs are seen as a quick solution to mainly the issues of declining fish stocks, natural coral reef degradation and an enhancement of the dive tourism industry. These structures alter the discourse of a natural marine environment and this may adversely impact the marine life therein.

There is a need for a thorough assessment of their impacts on the environment in the long run before such devices are used for its various purposes. Thus much, apart from monitoring those that had already been deployed in Malaysian waters, a long term study on the feasibility and practicality of using artificial reefs must be incorporated into management policies with regards to its use.

Background

The term “Artificial reefs” is used to denote those units of man-made structures intentionally or incidentally placed upon the seabed. The structures are made from waste materials, decommissioned structures as well as contraptions custom-made to become reefs. In place, these structures are supposed to meet a number of purposes, which can be broadly categorised into single or multiple functions of the following. Artificial reefs form an artificial habitat where fish tend to aggregate. In the case of large structures such as decommissioned oil rigs and ships, these reefs potentially serve as recreational dive sites. Sculptured artefacts sunk to form underwater galleries were similarly intended to form new dive sites. In addition, artificial reefs which deliberately alter the hydrodynamic flow of the water can also serve as a recreational surfing site. These alterations could also be an
attempt at coastal protection and nourishment. Artificial reef structures have also been used as an engineered construct for coral reef rehabilitation, recruitment and transplantation. However, not all of the artificial reefs in Malaysia are in place for all of those said functions. Where relevant, this position paper deals with those artificial reefs structures placed in Malaysian waters for purposes in a wider scale.

Artificial Reefs in Malaysia
The deployment of artificial reefs in Malaysia actually began through small-scale initiatives by traditional fishermen in the east coast of Malaysia, particularly in the states of Kelantan and Terengganu. These were created by sinking derelict wooden boats and other wood-based materials. A more orderly development of artificial reefs was undertaken by the Fisheries Research Institute, Penang, in 1975. This reef was constructed from rubber-based automobile tyres and deployed in the coastal waters of Kedah. This was a move to increase the colonization of marine life in the waters there. Preliminary findings were encouraging that in 1978 the Fisheries Department recognised a reef programme as a development project under the Third Malaysia Plan. This enabled the reef development programme to be expanded to other coastal areas to meet the following objectives:

- To enhance biological productivity in coastal waters through the creation of marine ecosystems which serve as sanctuaries for fish and other marine life;
- To generate the recovery of declining fish stocks in coastal waters, due to severe exploitation as well as environmental pressures in recent years; and
- To provide improved catches of fish to fishermen, and thereby a ready supply to the consumer

Since then, a number of artificial reef structures had been deployed all around Malaysia in both non-protected and protected marine areas. The artificial reefs were made from various materials such as tyres, concrete structures and scuttled ships among others. There are also decommissioned oil rigs in Malaysian waters which serve as artificial reefs. Although more often used to increase fish stock, rehabilitation of coral growth has also been attempted through the deployment of artificial reefs.

Environmental changes and the impacts of creating an artificial reef
Artificial reefs ultimately change the natural conditions of the seabed and invariably change its profile especially when the structure is of a massive size. Various types of non-natural materials have been used in the construction of artificial reefs. Most of these are waste materials that are conveniently disposed of and recycled as building materials for artificial reefs.

Artificial reefs for fish restocking and recruitment
The most notable change in an artificial reef environment would be that there is an increase in density and species of fish numbers in due time. While this may be a deliberate change in outcome, it needs to be clearly defined whether this phenomenon is simply an aggregation of fish densities or whether the fish actually had an increase in reproductive potentials. The difference is that the presence of the artificial reef structures is an enticement for fish to find new cover in the new artificial environment. These groups of fish migrate from a natural reef to the newly created artificial reef. The resultant effect on the original natural reef where the fish
came from needs to be determined that whether in due course, that reef becomes barren or otherwise. Furthermore, increased numbers do not necessarily equate to increased fish breeding and repopulation of stock within the new artificial reef environment. This matter is further complicated in cases where the main reason for artificial reef creation is to increase fish catch. The resultant increased aggregation of fish populations will lead to an increase in catch volume as expected. This leads to a high degree of fishing pressure not normally incurred on surrounding natural reefs where fish do not aggregate and are more often found scattered throughout a natural reef. As such, in the long term, the threat of over fishing and depleting standing fish stocks is very real. Even more so if there is no proper regulatory mechanisms for the management and monitoring of fish catches in these areas. However, the use of artificial reefs in these waters is an effective mechanism to prevent fish trawling in the area since trawling nets are prone to get torn up when it gets hooked upon the artificial reef structures.

Artificial reefs for coral recruitment and rehabilitation

There have been endeavours towards coral recruitment and rehabilitation of degraded natural reefs through the use of artificial reefs. The concept behind this is that the structures are placed near or even within both pristine and degraded natural coral reefs to promote the recruitment of new coral upon these structures. Following the same motives, transplantation of mature coral colonies upon the artificial reefs had also been practised to promote further growth. The viability of these techniques has been widely debated by those supporting and opposing the use of artificial reefs for coral reef rehabilitation. Theoretically, coral rehabilitation by artificial reefs is possible, and various scientific methods had been employed to encourage growth. However, success is relatively varied and overwhelming successes are very rare. Periodic bouts of recruitment have been observed but there had not been any indication of coral calcification overgrowth in the long term. Furthermore, restoration of huge tracts of degraded coral reefs using artificial reef structures are impractical since present techniques are already costly and extremely limited in success for major rehabilitation of reefs that were degraded.

Artificial reefs for tourism purposes

In the case of artificial reefs constructed by the sinking of decommissioned ships and oil rigs, the main purpose of these types of reefs are for the establishment of new dive sites for dive-tourists. These sites had varied successes for the tourism industry in areas where it was deployed. These types of reefs function mutually exclusively from reefs constructed for the fishing industry due to their opposing functions. Artificial reefs created for diving enthusiasts cannot be fished upon since fishing lines and fish nets pose a hazard to divers. Furthermore, these types of reefs are not suitable for fishing gear as they are prone to becoming entangled and stuck upon the reef structure.

Artificial reefs for coastal rehabilitation

Changes in the profile of coastlines may warrant intervention to reduce those natural processes that may result in infrastructure damage. The use of artificial reefs is an engineering endeavour to modify coastal hydrodynamic movements which could possibly mitigate such problems. As with any other engineering manoeuvres, a project such as this would entail extensive research and modelling of the coastal profiles which is very costly.

MNS’ recommendations

To the utilization of artificial reefs for the various stated purposes, MNS has outlined the following recommendations on their use in Malaysian waters:
1. Avoidance of any artificial changes in seabed structure:

The deployment of artificial reefs invariably changes the structure of the seabed. It is best that these natural areas are not disturbed or modified in any way to prevent any unforeseen and undesirable impacts that may result. Using these artificial structures for any reason is not recommended and highly discouraged. Even if any area warrants the use of these structures, the reason that validates the use of these reefs must be identified as a stress factor to the environment. There must be attempts to remove these stress factors as a primary action and considerations of other alternative measures that could be of use. Only then should artificial reefs be mulled to serve as a possible secondary follow-up method. If these stress factors are not identified, any attempts for the use of artificial reefs for its various reasons will be ineffective where it could end up in the same compromised state as that of the original reef.

2. Long term monitoring and study of artificial reef structures:

There have been numerous initiatives into the use of artificial reefs for various stated purposes. There must be a management policy and stringent guidelines that must be enforced where the use of artificial reefs is concerned. Ultimately, funding allocations for a long term study on the feasibility, stability and environmental impact of these reefs must be set aside. There have been a number of claims to the favourable use of artificial reefs, whether for fish restocking or coral reef rejuvenation. These claims can only be accepted with substantiated scientific studies showing clear evidence that the use of artificial reefs in Malaysian waters is favourable and meets its stated objectives. Without these studies, it cannot be said that the funding spent on artificial reefs is justified.

3. Provision of an Environmental Impact Assessment Study for artificial reefs in Malaysia:

Presently, there are no clauses for a detailed Environmental Impact Assessment (EIA) for the use of artificial reefs in Malaysian waters. It is recommended that a detailed study be made to evaluate the initiation, mitigation of possible adverse effects as well as outcomes of such projects and whether any aspect of the local community in the area would possibly be affected. Among others, the physical, biological and economic impacts of such a project must be identified before its commencement, as with other large-scale projects defined by the Department of Environment. Some further stipulations that should be considered are those pertaining to the deployment itself, the stability of the reef upon the seabed and the long-term monitoring of the sites for unexpected adverse impacts.

4. Use of materials constituting artificial reefs:

Components used in artificial reefs are often waste materials like tyres, building concrete and wrecks. These materials are often chosen as it is convenient to dispose of them as foundations of artificial reefs. Materials such as these may seem inert but are more likely to be very unsuitable in a marine environment. Contamination and pollution as a result of underwater
degradation of these materials would severely compromise the state of the marine environment. Thus, any materials that are intended for use as artificial reefs must be designed specifically for long-term underwater durability. Waste materials of any kind should not be used under any circumstances without a thorough investigation on its suitability. The same applies for the parts within structures such as scuttled ships and decommissioned oil rigs sank to form dive sites. Components that are deleterious to the marine environment within these structures must be removed prior to its deployment.

5. **Strict management for artificial reefs as a fish restocking and aggregation device:**

It has been established that artificial reef areas will eventually have high fish species diversity and fish density. As a result, these areas are fertile fishing grounds which benefit both the commercial and sport fishing industries. While contributing income to the various sectors, the resource itself needs to be stringently managed and monitored to ensure sustainable harvests. Strict regulations and enforcement must also be in place and be viable to prevent any destructive fishing practices that will harm the resource in the long run. One method where fish stocks could be managed is to implement a seasonal harvest structure. There should be times where harvest should be prohibited to allow the fish to repopulate that artificial reef area.

6. **Further studies on artificial reefs as a means for coral rehabilitation and recruitment:**

Despite all the effort to date spent on promoting coral growth through artificial reefs, there is still limited evidence of tangible successes. This is despite decades of research and funding in this area. It is acknowledged, however that anecdotes of coral recruitment upon the artificial reefs are many, but overwhelming growth has never been amply described. As long as there is no scientific evidence backing the success of artificial reefs in this matter, it is not advocated that these methods be employed for coral rehabilitation in any area. Present methods for stimulating coral growth are relatively costly and limited to a small area. As a means to rejuvenate coral densities in large areas impacted through natural or anthropogenic causes, it is neither practical nor feasible to attempt coral growth restoration through the use of artificial reefs.

7. **Deployment of artificial reefs in Malaysian Marine Protected Areas:**

The addition of artificial reefs structures to waters of Marine Protected Areas (MPAs) can be seen as an unnatural modification to the present reef both in terms of the natural reef’s functions and its aesthetics. It is not recommended that artificial reefs be deployed in MPAs since one of the functions of an MPA is that these areas are fish no-take zones. Deployment of artificial reefs for the enhancement of fish populations is thus contrary to this role of an MPA. These structures would also stand out as an unnatural sight in the area. This could consequently lower the aesthetic value of the MPA where a pristine state of the reef is very much sought after by divers and snorkelers.
Conclusion

The use of artificial reefs in Malaysia can be broadly categorised into three main functions: fishery enhancement, coral rehabilitation and tourism generation. Notwithstanding the reasons for its usage, the impact of such devices in the long run must be considered and accounted for. Due to the fact that these structures had been utilized for some time already, there should be a review of the success or failure of the present artificial reef program in Malaysia as a whole. It must also be emphasized that the usage of artificial reefs should not be a substitute for a lack of a policy and management for the protection of existing natural reefs. These natural reefs invariably need to be protected despite the existence of various new techniques to construct new reefs. MNS is of the position that the use of artificial reefs should be avoided until conclusive findings on the suitability of its intended usage can be clearly defined and quantified. This includes extensive research into the science of it where an increased knowledge and insights into its mechanisms may have other applications than those that are already identified. Following that, there must be a management policy on the guidelines to its proper use as well as a monitoring mechanism that should be consistently adhered to.