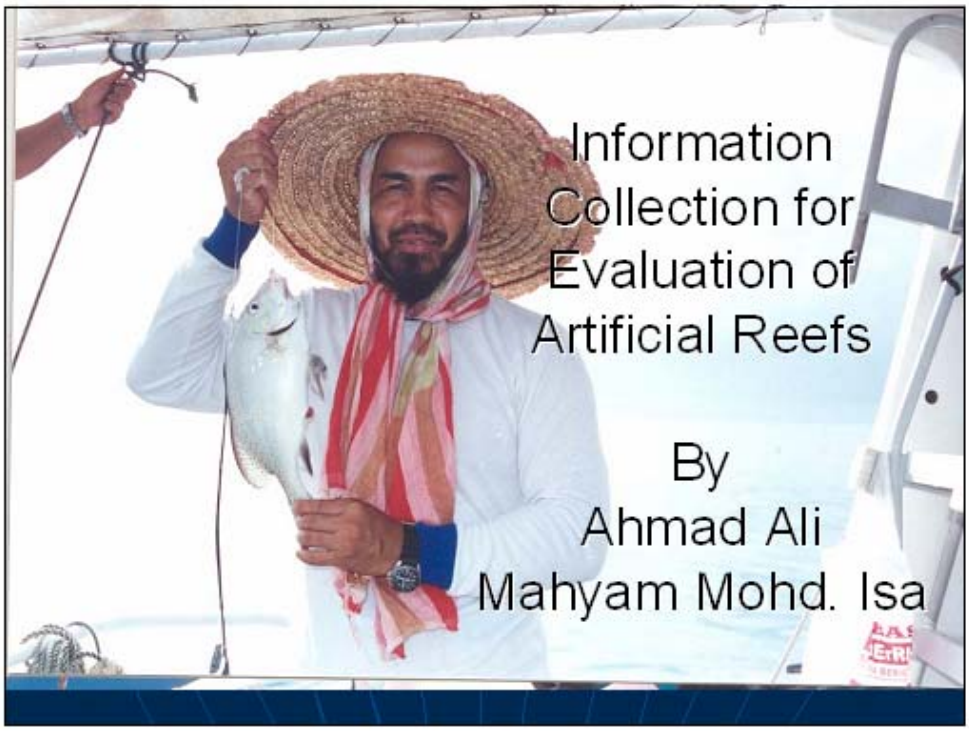
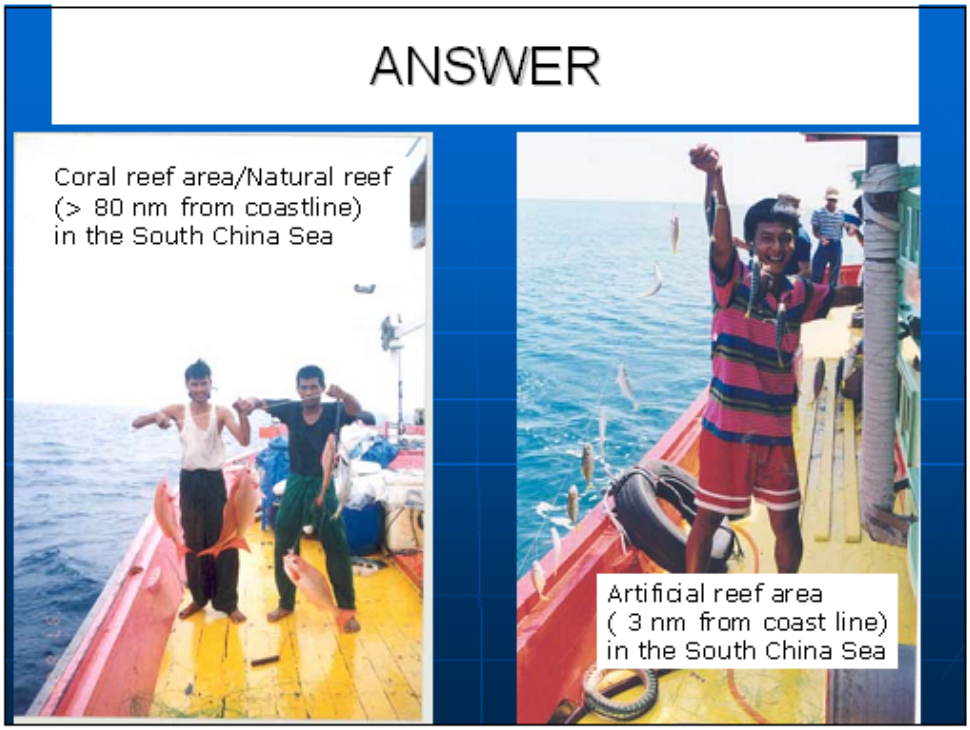
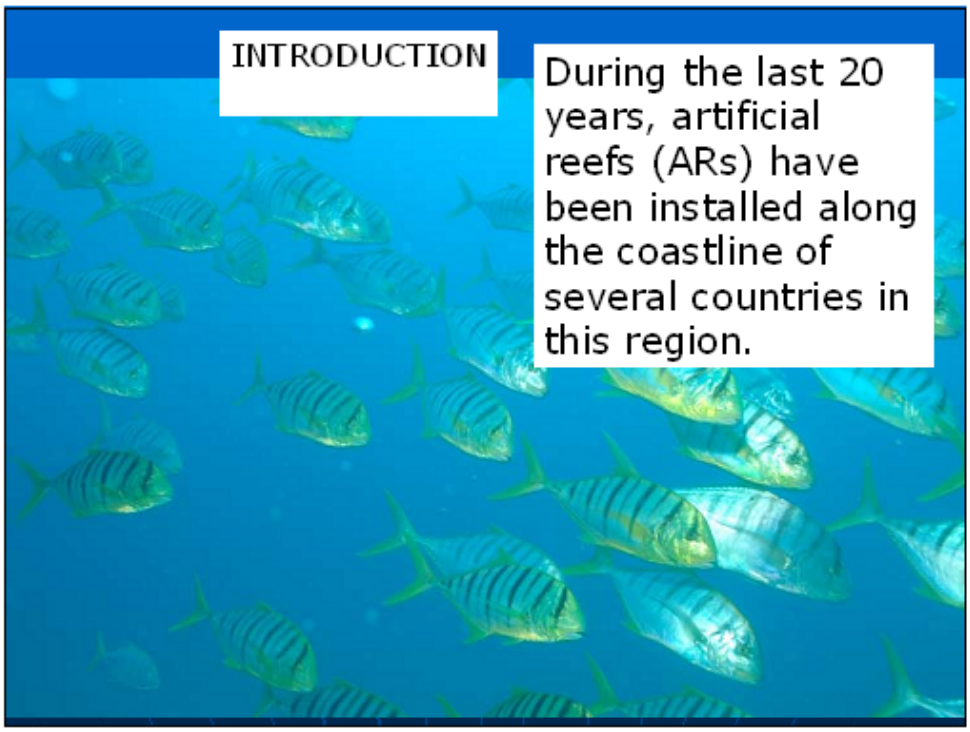
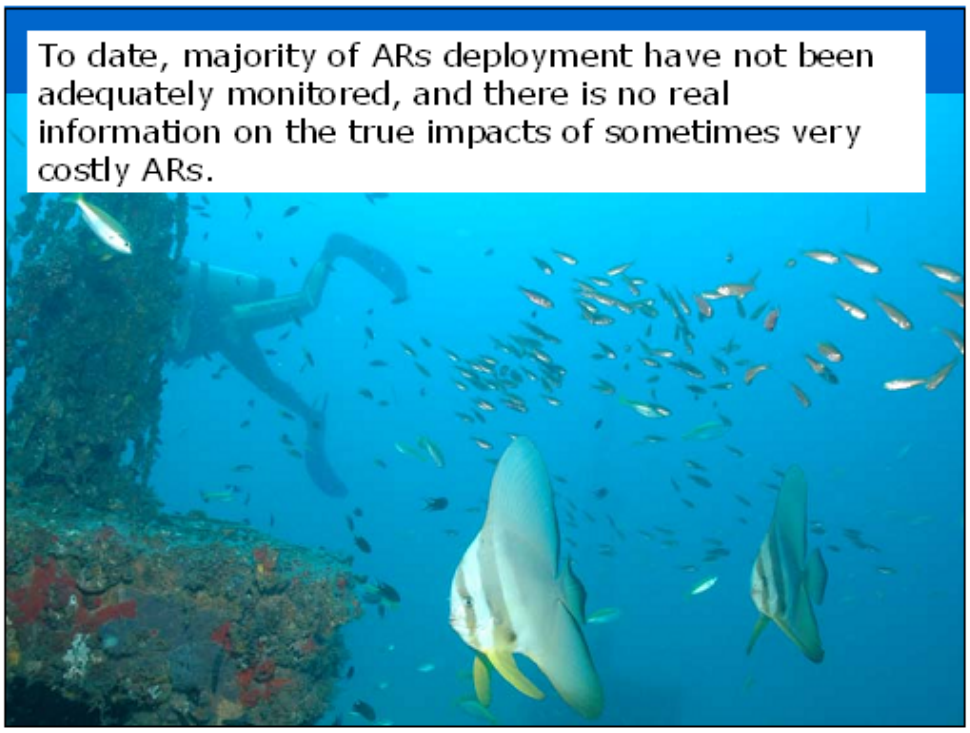
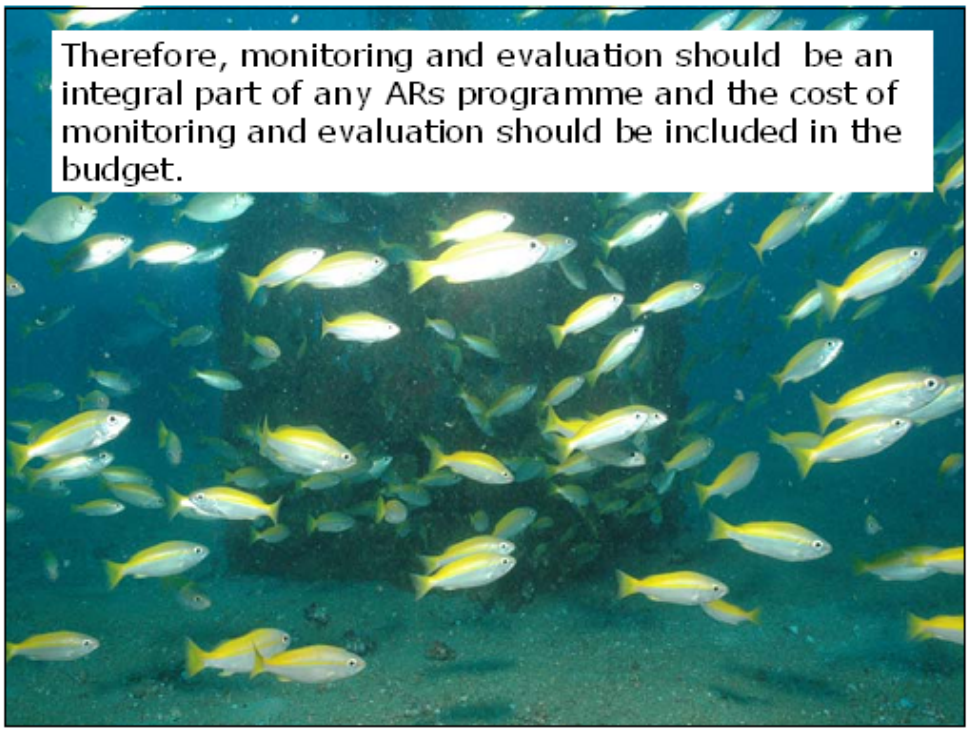

Information
Collection for
Evaluation of
Artificial Reefs
By
Ahmad Ali
Mahyam Mohd. Isa

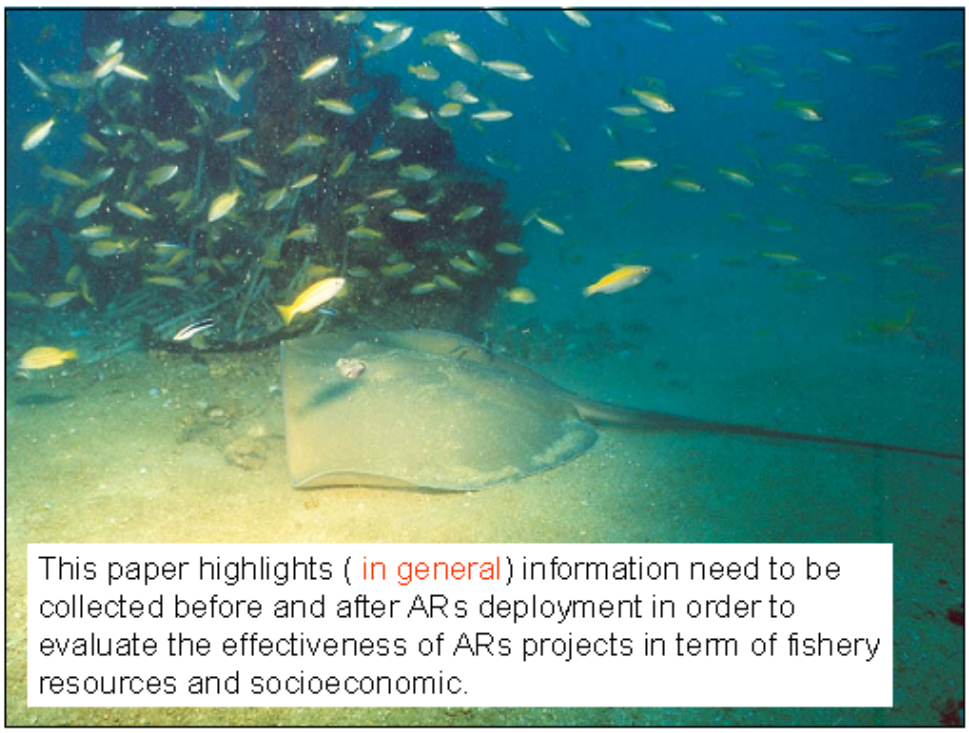

WHERE ARE THEY FISHING?
A
B

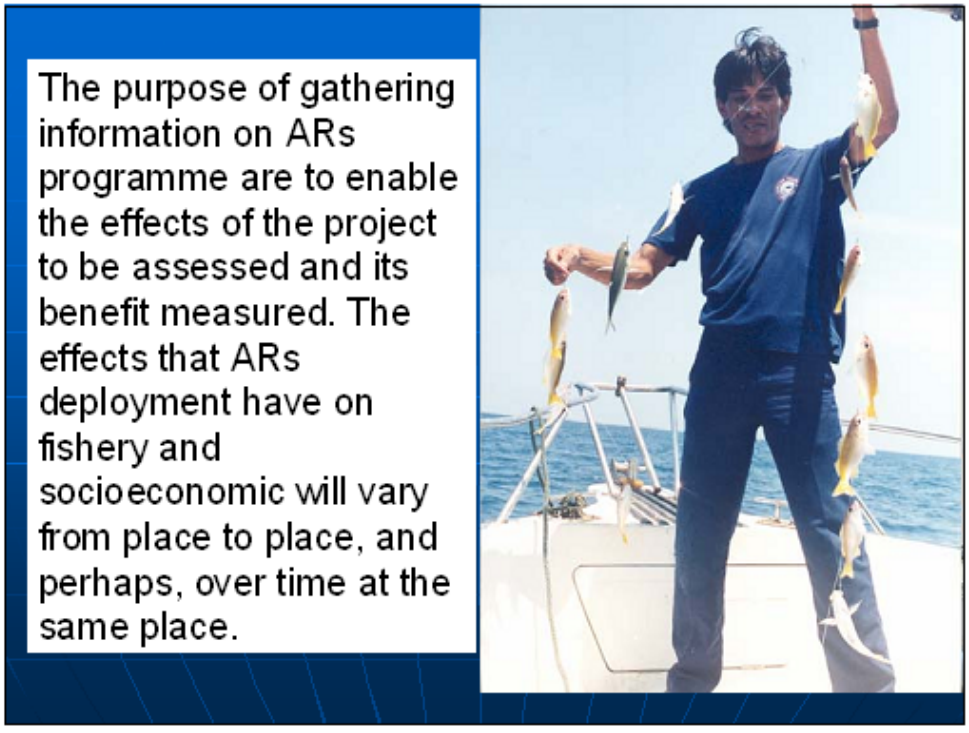

ANSWER
Coral reef area/Natural reef
(> 80 nm from coastline)
in the South China Sea
Artificial reef area
(3 nm from coast line)
in the South China Sea


INTRODUCTION
During the last 20 years, artificial reefs (ARs) have been installed along the coastline of several countries in this region.


To date, majority of ARs deployment have not been adequately monitored, and there is no real information on the true impacts of sometimes very costly ARs.


Therefore, monitoring and evaluation should be an integral part of any ARs programme and the cost of monitoring and evaluation should be included in the budget.


This paper highlights (in general) information need to be collected before and after ARs deployment in order to evaluate the effectiveness of ARs projects in term of fishery resources and socioeconomic.


The purpose of gathering information on ARs programme are to enable the effects of the project to be assessed and its benefit measured. The effects that ARs deployment have on fishery and socioeconomic will vary from place to place, and perhaps, over time at the same place.

Some surprises can result, including unpleasant ones. The potential for ARs to provide expected benefits may be reduced unless a careful assessments of their impact are made.

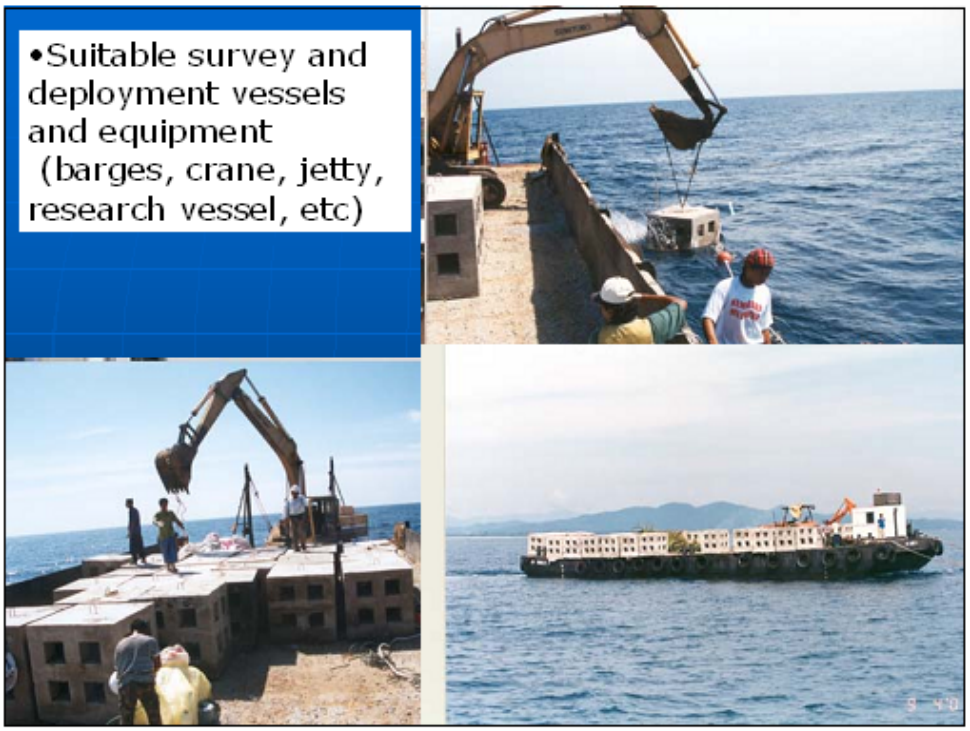
RESOURCE NEEDS IN THE IMPLEMENTATION OF ARs PROGRAMME

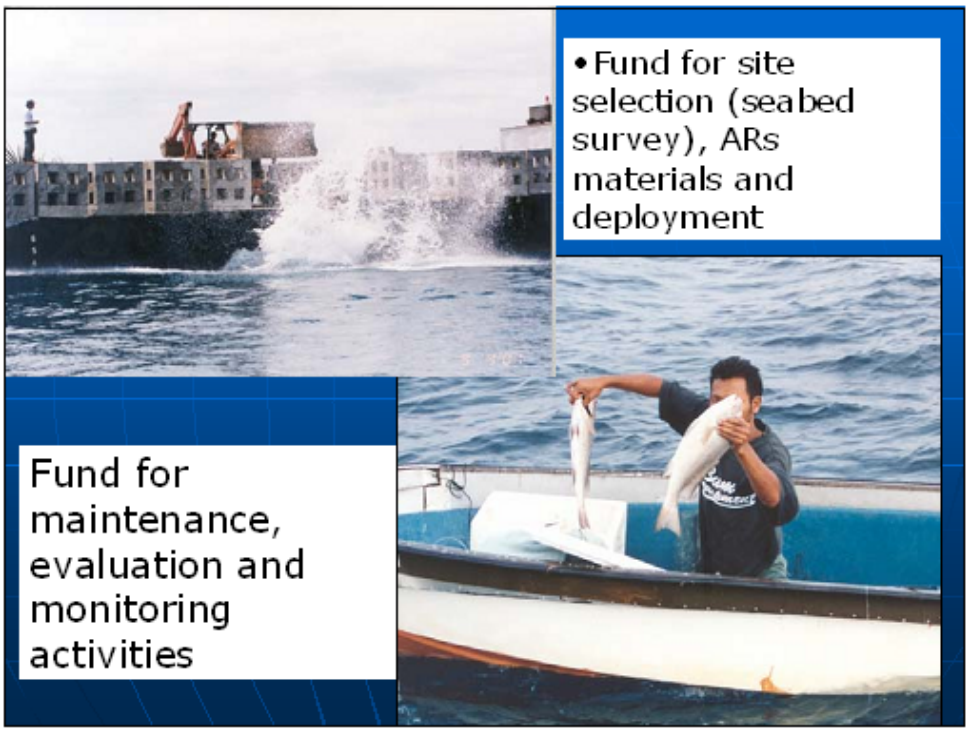
Certain basic resources are needed to implement a successful ARs programme. These include;

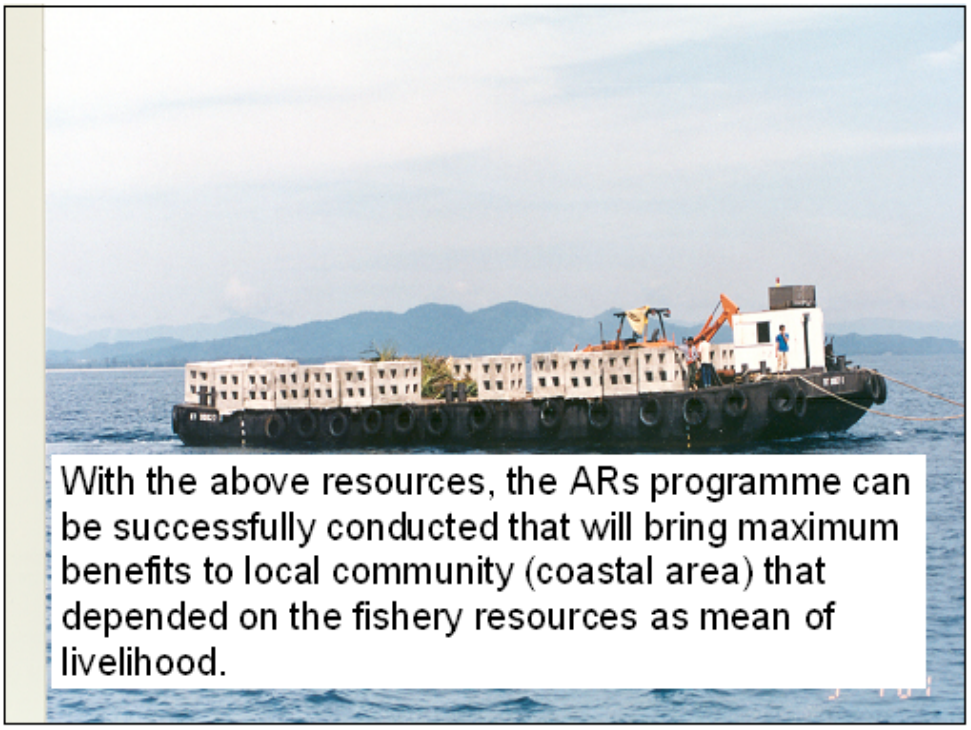
- Sufficient skilled manpower (fish taxonomist, marine biologist, oceanographers, socioeconomics, marine engineer, etc)


Biologist


Certificate Divers


•Suitable survey and deployment vessels and equipment (barges, crane, jetty, research vessel, etc)


•Fund for site selection (seabed survey), ARs materials and deployment
Fund for maintenance, evaluation and monitoring activities



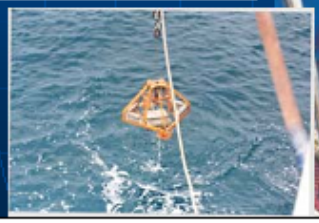
Methods of Information Collection

- There are two main methods collection of information, which are referred to as active and passive.
- The active collection involves visiting to the areas and carry out research activity, interview and gathered anecdotal information from fishers and others. It is thus a labour-intensive operation requiring a significant commitment of manpower and funds.
- Passive information collection, on the other hand, relies on fisher themselves providing the requested data in a standard format, usually through filling in log-books or pre-printed data forms. This method of obtaining information is cheaper and less labour-intensive.

Note: Collection information should be a regular activity.

Although the extent to which information can be obtained will be limited by the financial and human resources available for data collection, ideally these should include:

- Site Information
- Biological information
- Geological information
- Oceanographical information
- Engineering information
- Socioeconomic information



SITE SELECTION

To date, majority of ARs deployment have not been adequately monitored, and there is no real information on the true impacts of sometimes very costly ARs.

Using a checklist enable those sites that are least suitable for ARs deployment to be detected. Prioritization of the various criteria listed here will largely depend upon local circumstance and the objectives of the ARs programme.

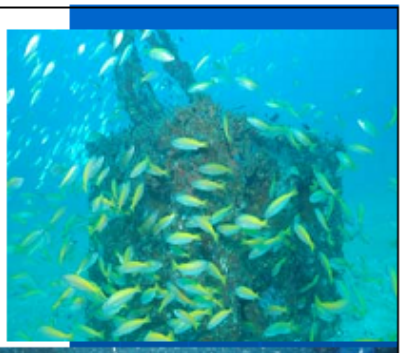
The check-list below shows most of the important characteristics to be considered, and can be used to refine the site selection process:

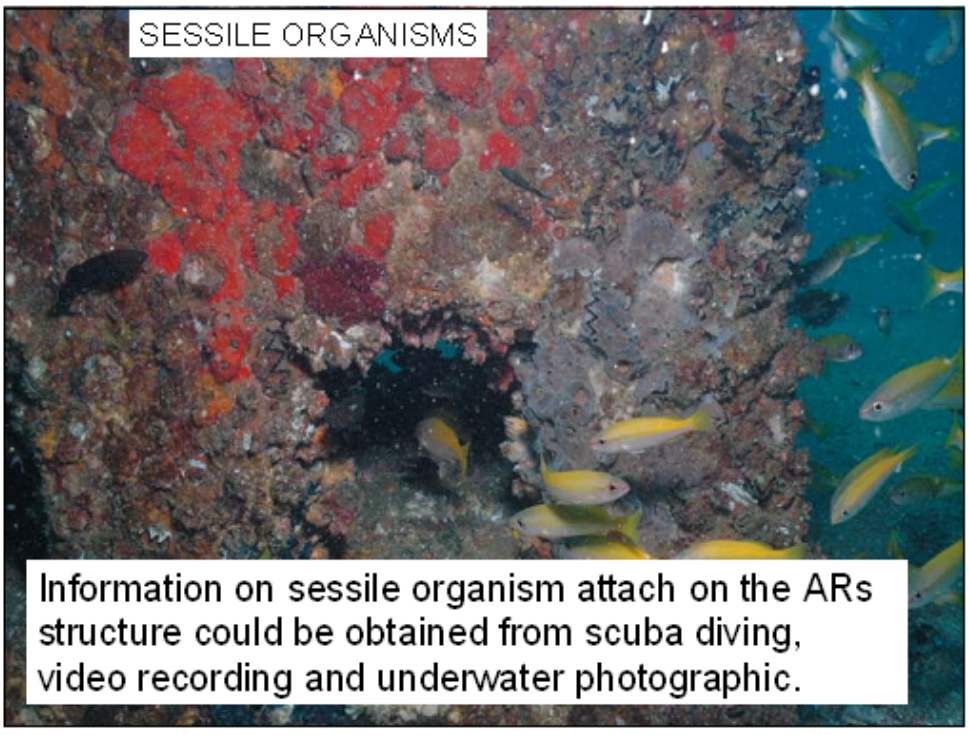
- Type of sea floor
- Current speed
- Wind and storm
- Market
- Distance from fisher village
- Gears used by local fishers
- Number of fishermen
- Risk of conflict between different communities
- Limitation of fishing area
- Capability of local fishers to maintain and look after ARs

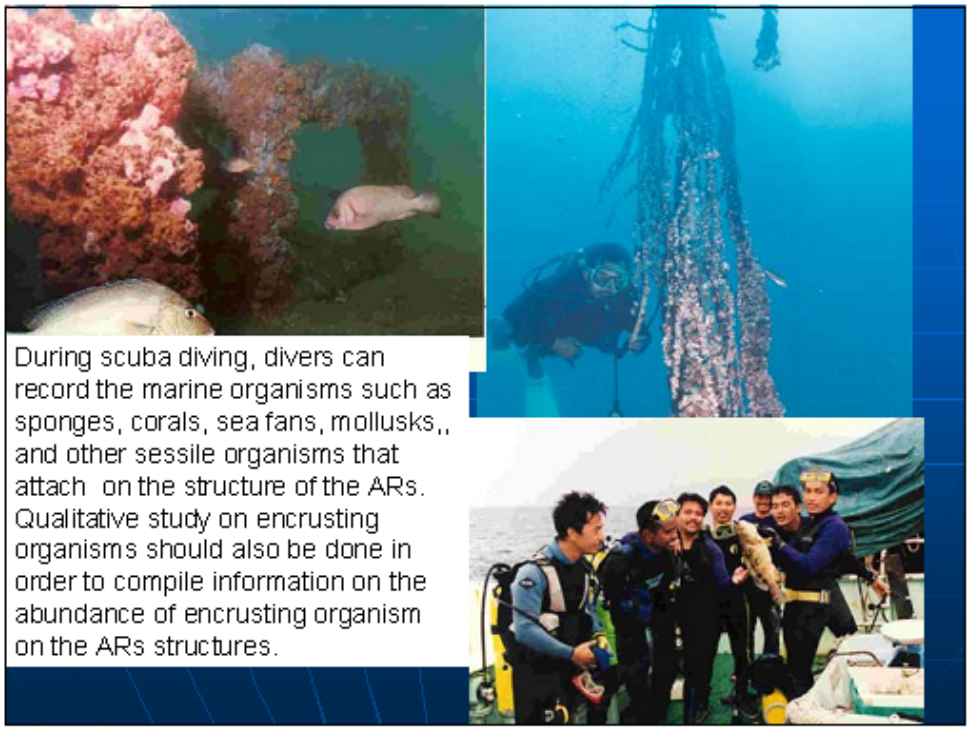
Biological Information

Information on the rapid increase of resources by installing ARs must be recorded to confirm that the ARs acted positively in creating fish communities. These include:

- Sessile organism
- Fish species composition
- Benthic community
- Fish larvae

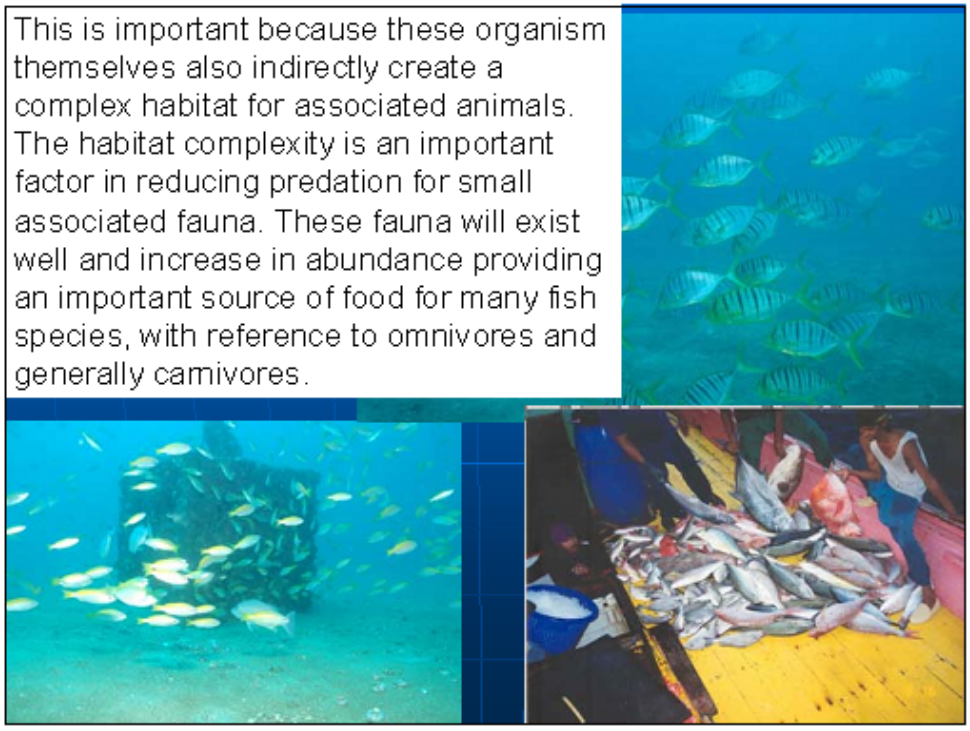






During scuba diving, divers can record the marine organisms such as sponges, corals, sea fans, mollusks,, and other sessile organisms that attach on the structure of the ARs. Qualitative study on encrusting organisms should also be done in order to compile information on the abundance of encrusting organism on the ARs structures.

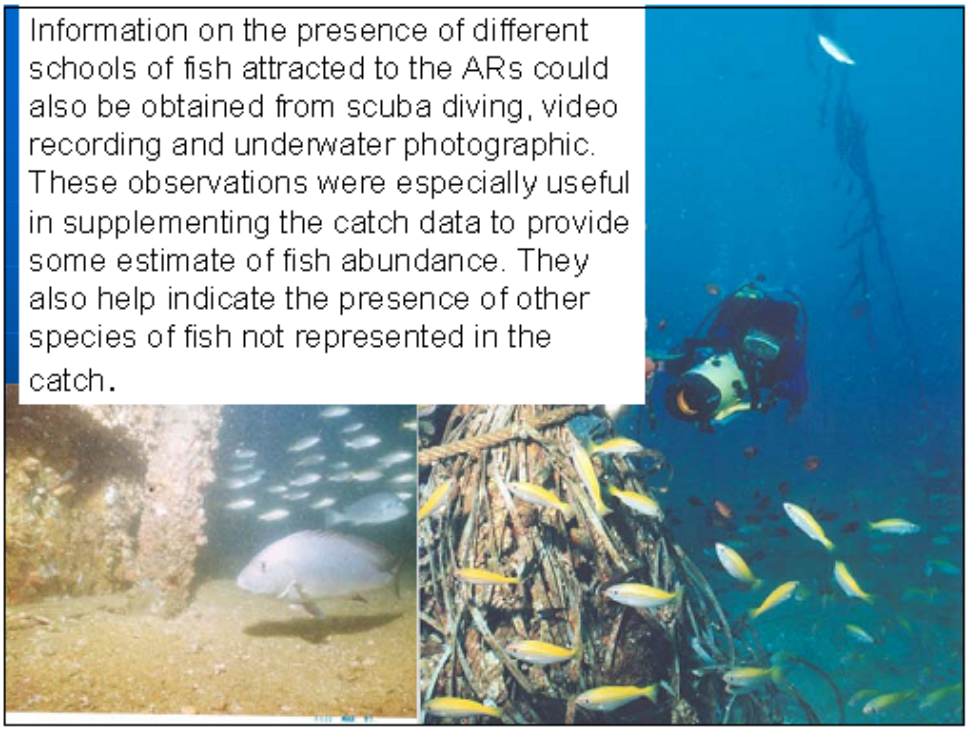
This is important because these organism themselves also indirectly create a complex habitat for associated animals. The habitat complexity is an important factor in reducing predation for small associated fauna. These fauna will exist well and increase in abundance providing an important source of food for many fish species, with reference to omnivores and generally carnivores.



There is no specific schedule to collect this information. However, regular monitoring at every 3 month basis could provide very good information. Survey methodologies used by research divers included intersected transect method for sessile organism, visual observation via transect, fixed stationary points and search pattern. Permanent quadrants were also used to record changes in the community structure and population level of encrusting organisms.

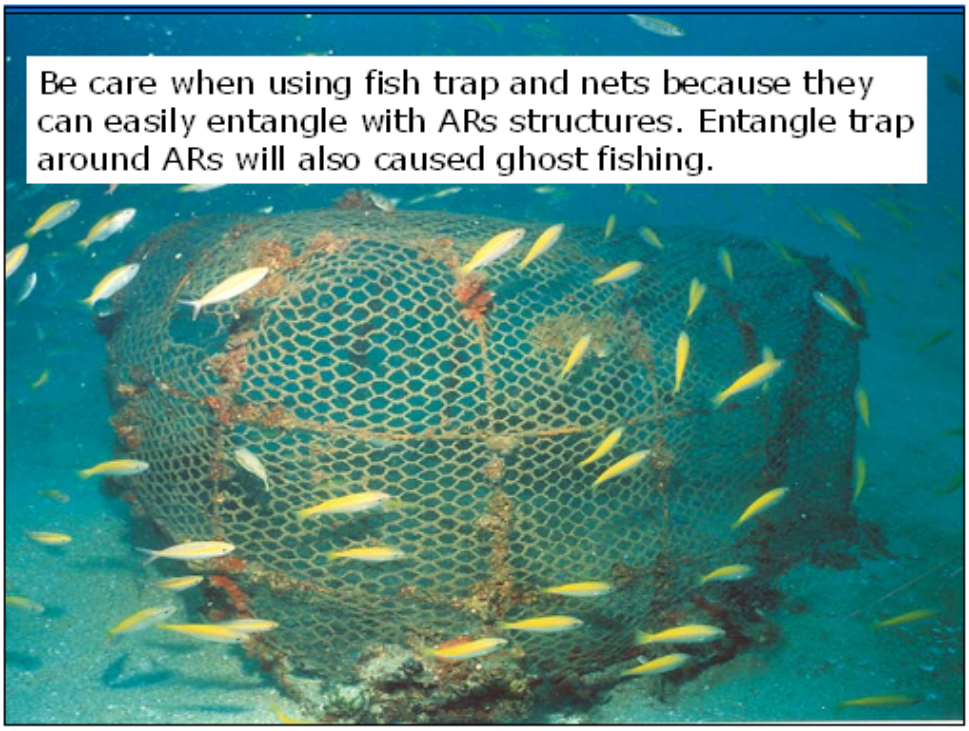
Preliminary baseline study on fish resources (commercial and non commercial species) should be carried out, prior to the establishment of the ARs. Such baseline studies could be carried out in conjunction with the surveys. The use of fish trap as well as hooks and lines could provide some preliminary indication of the fishery resources of the selected sites.

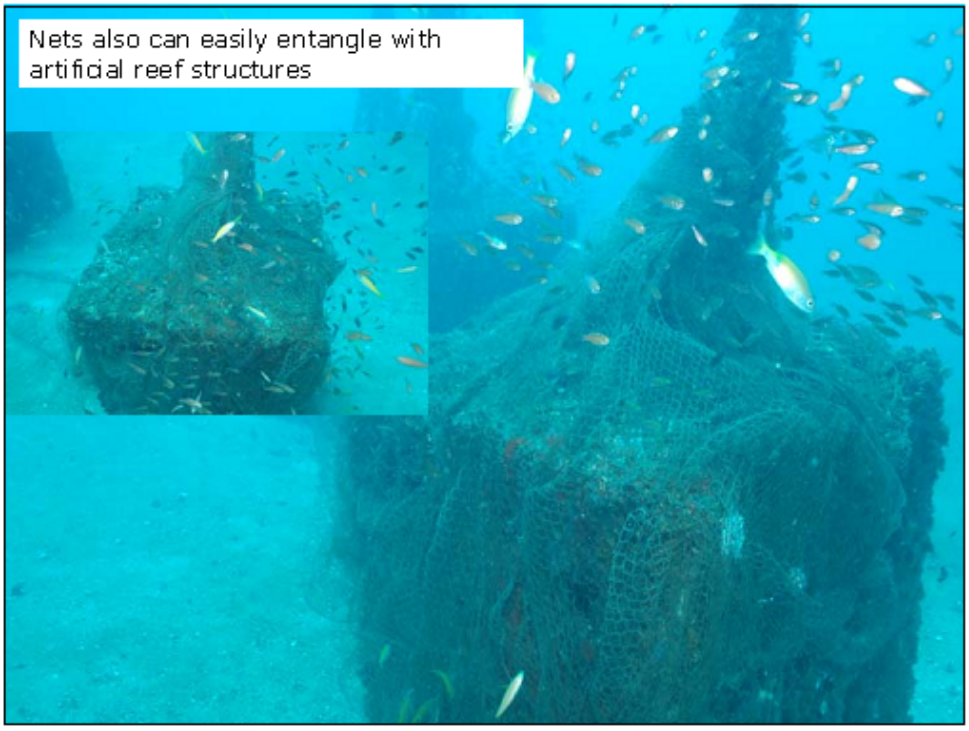
Information on the presence of different schools of fish attracted to the ARs could also be obtained from scuba diving, video recording and underwater photographic. These observations were especially useful in supplementing the catch data to provide some estimate of fish abundance. They also help indicate the presence of other species of fish not represented in the catch.

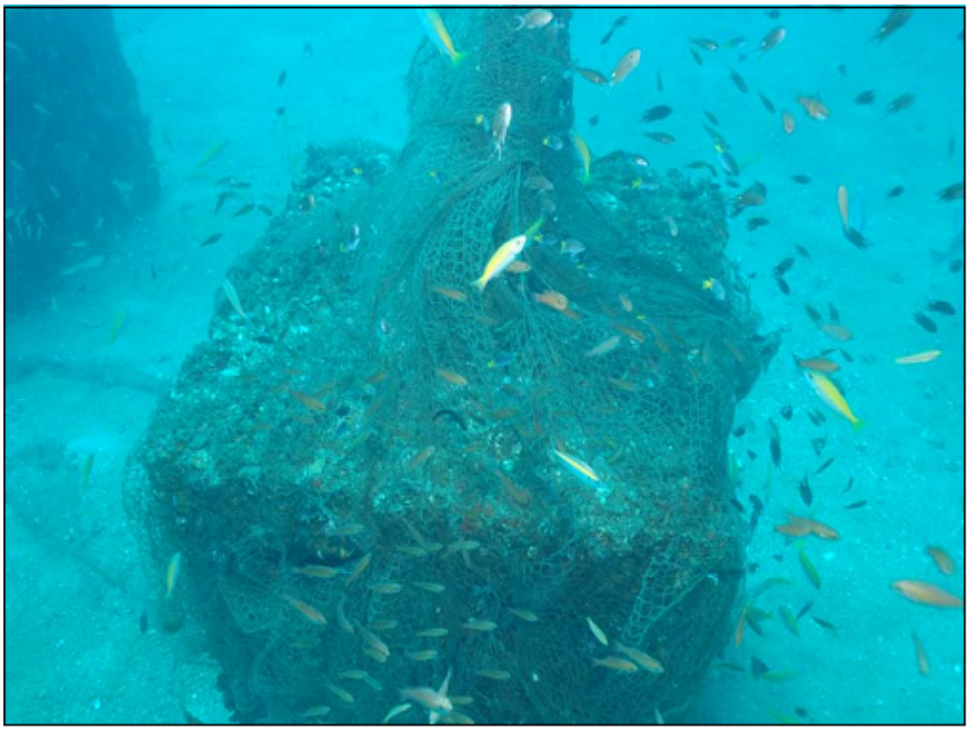


Observation by fishfinder or echo-sounder also provides information of the fish around the ARs but not to the species level. Fish species observed by underwater visual observation should be listed during each diving activities. Nights diving also recommended in order to getting more diversify information on fish species.

The best methods to collect information on species composition on commercial species around ARS are hand lines, squid jigging and trolling.


Be care when using fish trap and nets because they can easily entangle with ARs structures. Entangle trap around ARs will also caused ghost fishing.


Nets also can easily entangle with artificial reef structures



- Sampling activities could be applied during day and night time. Sampling should be conducted monthly in order to get better information. Data on the catches, strikes, and efforts should be collected. Fish caught must be recorded according to the species, weight and number. The length, weight also must be recorded.

Benthic Community

Benthic community especially macrofauna is considered to be affected by the installation of the ARs, and it is considered to play an important role in the ecosystem. Normally the density of benthic macrofauna is higher inside the ARs area than outside.

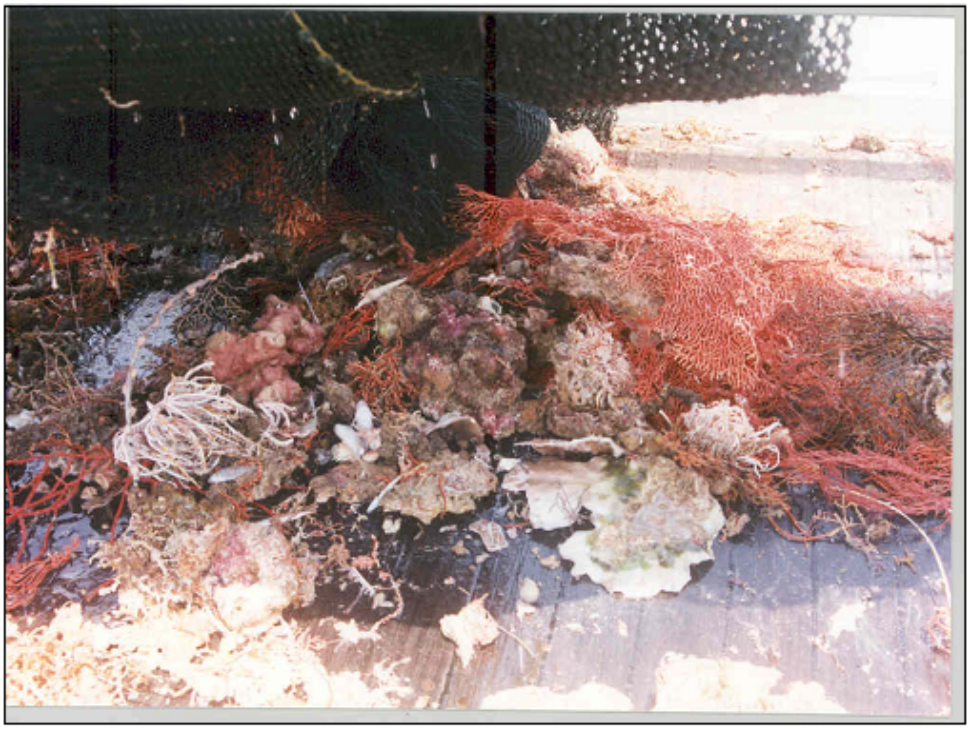
Sediment sample for benthic macrofauna can be collected by using grab sampler. Specimen than identify into taxonomic group at least at family level to obtain information on species composition, density and community characteristic. The Species Evenness Index (J) and Diversity Index (H) could be used to measure species diversity and richness. This information could be conducted prior to the deployment of ARs and every 6 month to one year basis after the depyoyment.

Fish Larvae

The present of multispecies fish as well as their larvae around the ARs proved that this structure has turned into new habitats that resemble natural habitat for several demersal fish species as well as sanctuaries and nursery for fish and other marine life. Information on the presence of different fish larvae species attracted to the ARs could be obtained by using bongo net. This information could be conducted prior and after the deployment of ARs.

Geological Information

It is very important to take sediment sample before any deployment of ARs. The particle size composition of the bottom under an ARs can play a vital role in the effectiveness of the artificial reef structures. Sediment particles are divided into several different size ranges based on their average diameter. In general a bottom composed largely of all sand size particles would be suitable for artificial reef site while bottom composed of unconsolidated clay size particles would not support even low density reef materials.

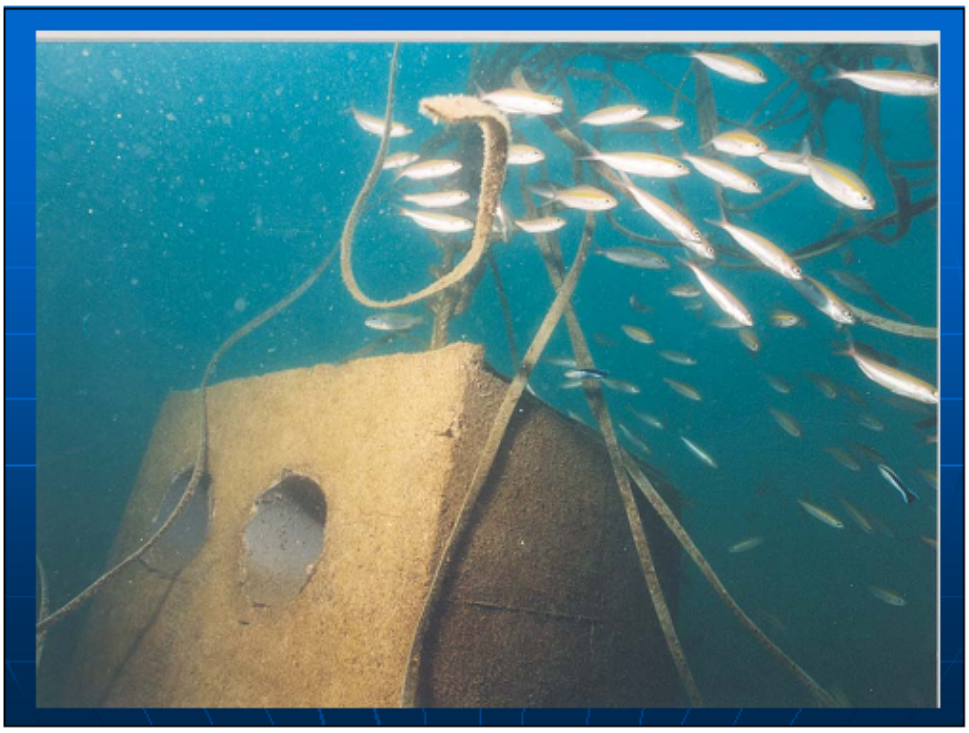


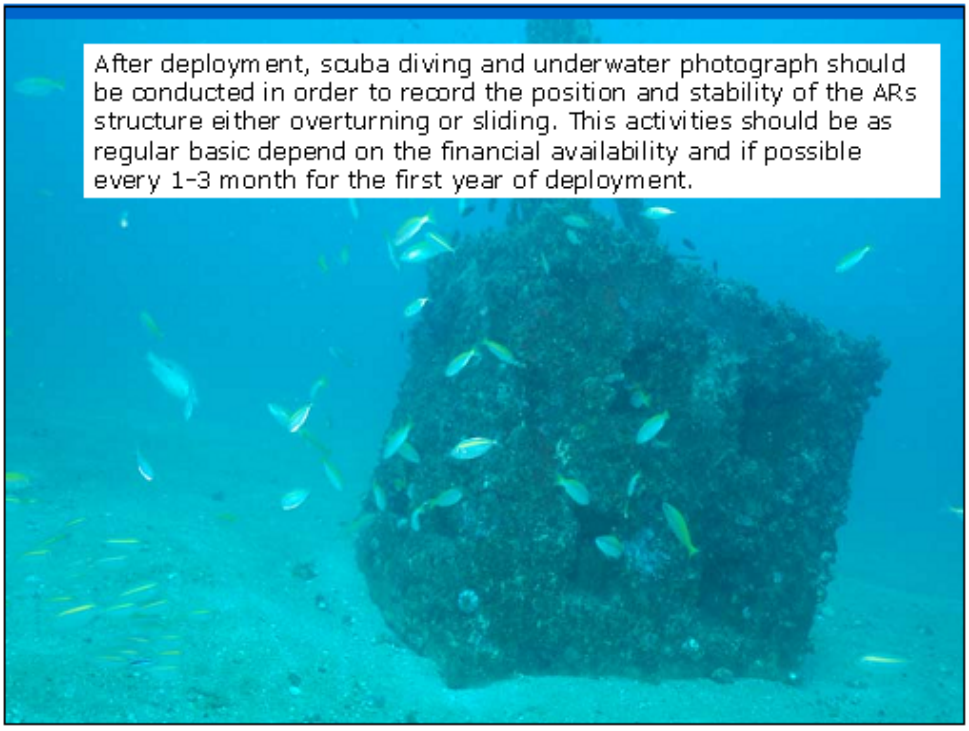
Oceanographical Information

The most important oceanographical data are current. These data should be collected over a long period in order to understand the changing of wave and current speed as well as their direction. Other information those should be collected included, plankton diversity, salinity, suspended solids and temperature. While sediment traps could be used to determine the level of sedimentation at the artificial reef sites.

Engineering Information
Stability of ARs Structures

When considering the design of ARs, the simpler shape is better. Another factors are the stability of the modules again the wave action and current.




After deployment, scuba diving and underwater photograph should be conducted in order to record the position and stability of the ARs structure either overturning or sliding. This activities should be as regular basic depend on the financial availability and if possible every 1-3 month for the first year of deployment.

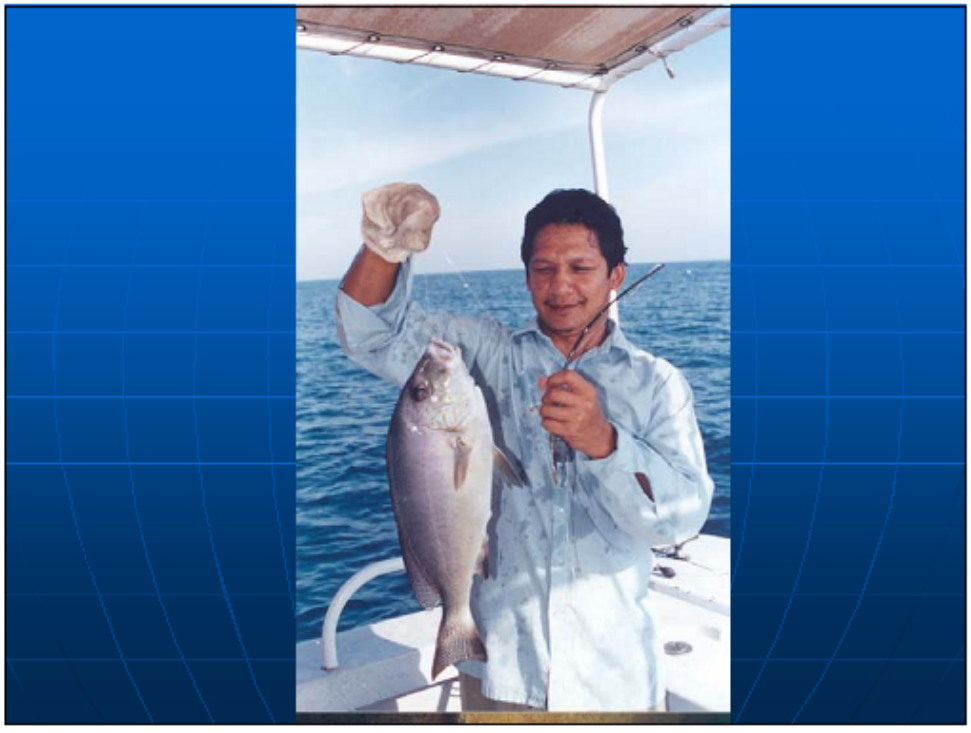

Socio-Economic Information
•Catch and Effort Data
•Economic Data
•Market
•Social
•ARs Usage

CATCH AND EFFORT DATA

It will be impossible to collect data on every fish caught by every boat, but the information collection programme should be design to obtain representative samples so that information for the multiplying up the data gathered. A representative number of fishing vessel should be sampled from time to time and following data recorded for each fishing trip:

- Fishing area or ARs location
- Fishing method used
- Time spend using each method
- Total number and weight of each species caught by each fishing method

It is valuable to measure the individual lengths and weights of representative samples of fish caught. This will allow investigation of changes in the nature of the fish resource itself over time, and will be especially valuable in the distant future when questions of resource over-exploitation may arise.



In addition to the catch and effort data, sampling of fishing vessel should also include gathering of the following set of economic data:

- Length of fishing trip
- Cost of fuel, bait, ice and other expendable items used during the trip
- Price for each different species

Comparison of these data with information obtained before the ARs were deployed makes it possible to assess of the real economic impact of the ARs.

MARKET

As well as gathering economic data from fishermen, it is important to obtain similar information from as wide a variety of retail and wholesale market outlets as possible. These include the level of demand for fresh fish in local, urban and rural area. There are usually local preferences for certain species of fish. In some area, certain species are not familiar with locals and they fetch lower prices, while in the other areas the opposite is the case.

Social

Social information is not as amenable to quantitative sampling than catch-and- effort and market data. However it should be possible to obtain qualitative information on the social impacts of an ARs programme through communication with ARs users.

ARs may change the way fishermen organize their time. Fisher can target particular fishing areas and organize their day fishing trip to the ARs, rather than searching open water for fish and having less chance of making good catches. This may allow them to spend more time on other economic or subsistence activities or to have more leisure or family time.

One important potential impact is the creation of new activity such as recreational fishing. In particular, fishers are likely to use their facilities to organize fishing trip to family member, friend or anglers as part-time job.

ARs Usage

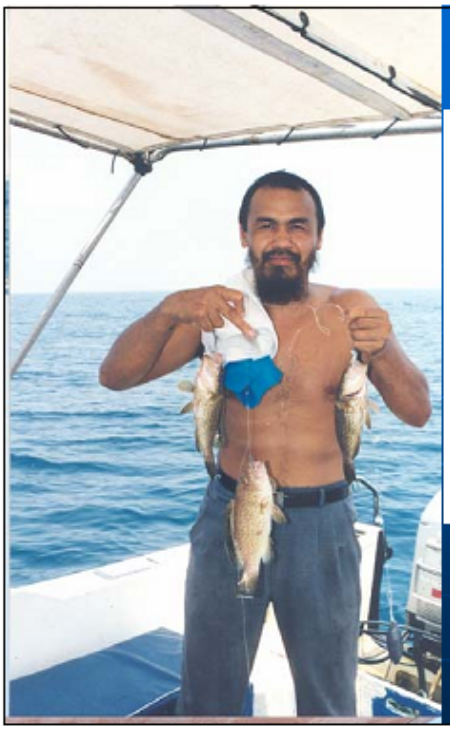
If the ARs were deployed To create a new demersal fishery or enhance an existing one, an estimate of the numbers of traditional fishers using ARs should be made.

If the intention of deploying ARs was to reduce pressure on the coastal fishery, it is important to find out whether inshore fishers have switched to use ARs and also the number of recreational fishing are making use of them. Information on the numbers and types of fishers using an ARs, and the reasons why they enter and leave the fishery, will allow planning for new ARs deployment, and the avoidance of conflicts between users if overcrowding appears to be a problem.

Alternatively, if the fishers are not fishing at ARs as much expected, it is important to discover why. The ARs may be not aggregating good quantities of commercial species, in which case the only real solution is to look for more productive sites.

CONCLUSION

- Investment in ARs programme, like any investment, contains an element of risk.
- When ARs deployment have considered as an *ad hoc* fisheries development tool, with little considering being given to the wider context (socio-economic, biology, geology, oceanographic etc), conflict, useless, unproductive, and wasted funding have often been the final outcome.
- The benefit of the ARs programme can be maximized, the cost minimized and the risks of failure reduce by proper planning, good management, consistent and adequate in monitoring and evaluating



GRACIAS

AND

HAPPY FISHING