

## Primary fishery assessments and status from catch statistics

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Primary assessments of fish catch from AR sites are done by ICAR-CMFRI, following a multi-stage stratified random sampling (MSSRS) technique introduced by the Institute to assess marine fish landings in the maritime states of India (Srinath et al., 2005). Hooks and lines and gillnets operated from traditional boats and motorized FRP boats are usually the chief gears monitored for fish catch assessments from AR sites. The villages or landing centres having AR are surveyed on a fortnightly basis as per MSSRS and the fishes landed by boats fishing in the AR site are identified and quantified. For comparison, the landings from non-AR sites (either in the same village or in the adjacent village without AR, if the former does not happen) are also surveyed simultaneously. The monthly catch from AR and non-AR sites are compared over a year or more. The catch from an AR site is also compared with the catch recorded in the previous year from the same site before the deployment of AR, obtained from the database of ICAR-CMFRI.

The catch per unit effort (CPUE, kg) where effort is the number of boats operated is taken as the index of performance.

$$\text{CPUE (kg)} = \frac{\text{Total catch by all the observed boats (kg)}}{\text{Number of boats observed}}$$

The catch and CPUE are compared for the total catch as well as catches of individual resources (either families or species, based on the occurrence and dominance in the catch). The percentage of variation across years in the AR site and between AR and non-AR site are estimated to understand changes in species composition, shifts in species dominance, catch trends and seasonal abundance of resources.

Fishery assessments provide an accurate measure of the species composition and abundance in the AR site; however, they tend to be biased towards resources that interact with the gears deployed and may not provide a complete picture of all the resources that may be housed in the AR. Nevertheless, fishery assessments provide the most reliable account of the maturation of the reef and its capacity to sustain an economically viable fishery, and thus the livelihoods of the fishers who fish regularly in the AR site.

### Stock assessments

With catch and effort data assimilated from the AR site over a continuous period of 5 years and more, the status of the stocks that support the commercial fishery can be assessed using

surplus production models, which give an idea of the maximum sustainable yield (MSY) and the effort level at which it can be obtained ( $F_{msy}$ ). This can be assessed for the entire reef catch as a whole taken by a single gear (eg., hooks & lines), or by multiple gears (egs., hooks & lines and gill nets) after gear standardization. The status of individual resources can also be assessed (eg., snappers, groupers, barracudas, scads etc.).

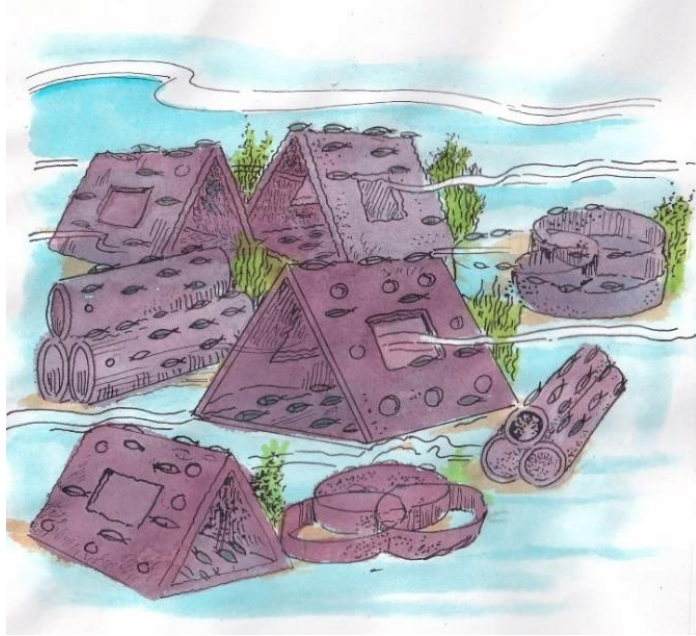
### **Length-based species-wise stock assessments**

With continuous data on the length frequency of different species in the AR fishery, length-based stock assessments can be done using microanalytical models which require biological parameters of growth and mortality as inputs. For small, short-lived species like sardines, mackerel, scads etc., data over two years will be sufficient. For medium-life span fishes like small perches, data for two-three years is required. For larger, long-lived species like seerfish, barracudas, tunas, groupers etc., the data requirement will be for five years or more.

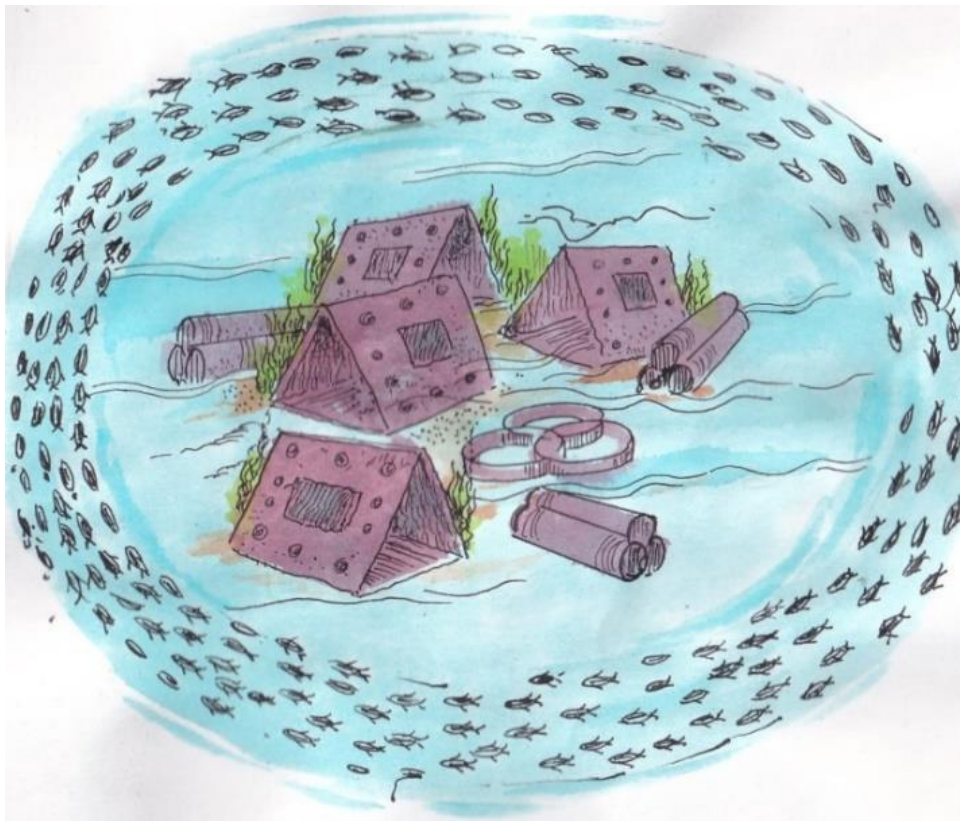
Length-based stock assessments provide information on the behaviour of individual species and allow estimation of standing stock biomass (B) and spawning stock biomass (SSB), at the current level of effort (F) and  $F_{msy}$ . The indicators  $F/F_{msy}$ ,  $B/B_{msy}$  and  $SSB/B$  are reliable descriptors of the health of the stock, particularly in the case of resident species.

While attempting length-based stock assessments, it is necessary to ascertain the nature of occurrence of the species, i.e., whether it is resident or migrant and whether it frequents the reef only in a particular phase of its life. Resident stocks will ideally be always present in the catches from the reef. However, there may be chances of only a particular life phase interacting with the fishery, in which case the length frequency will be biased towards those size classes (eg., groupers – juveniles and young adults are likely to be caught while larger adults tend to remain solitary at the bottom, usually within the crevices of the reefs and thus are rarely represented in the fishery).

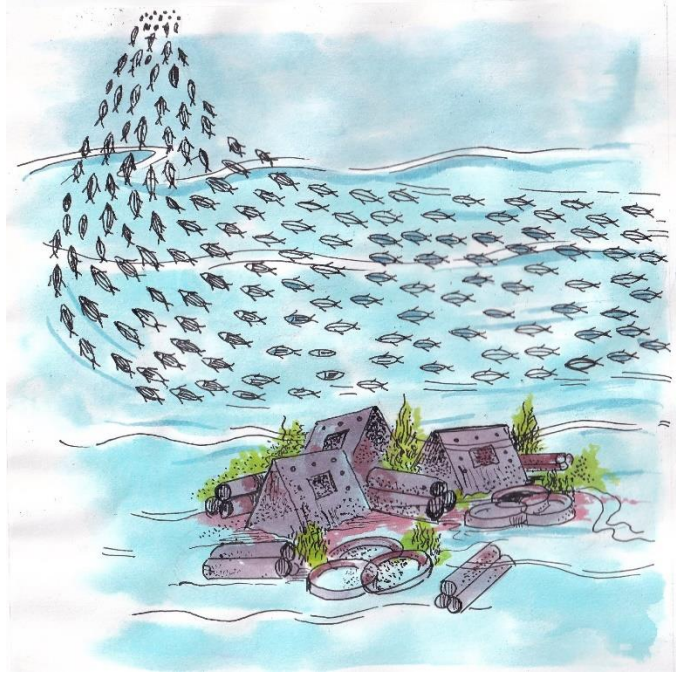
Integrating the results of fishery assessments and stock assessments with the data gathered from direct underwater observations and ROVs will provide a near-perfect profile of the fishery resources supported by the artificial reefs.



**Fig.55. Benthic community in contact with the reef surface**



**Fig.56. Demersal community surrounding the reefs**



**Fig.58. Forage fishes in the immediate water column above the reefs**



**Fig.59. Large predators and pelagics on the topmost surface**