

450 MeV Indus-1 with its beam lines are functioning. Users of synchrotron radiation should fully use both Indus-1 and Indus-2, and compete for beam time at other better synchrotron sources. Experimental facilities at the Indus machines have been built for all scientists in India. They may not match always with the best, but let it also be said without doubt that the best is never available off the shelf. They have tremendous capacity to produce original and high-quality science; their utilization must be maximized by scientists from outside DAE laboratories. The case for a better machine is strong. Equally strong is the need to create a large enough community of users through full utilization of existing machines. Finally, there is a compelling requirement for all concerned to put their heads together.

Notes

1. The controlled nuclear explosions of 1974 and 1998 were a joint effort of the DAE and defence establishments, and not only of the latter as mentioned in the Guest Editorial. DAE started the initiative and took responsibility of the nuclear part; defence establishments took care of the

conventional weapons technology, and the two worked as a single team. Equally important was the policy decisions of the existing governments. Tenzing Norgay and Edmund Hillary never revealed who stepped first on Mount Everest; it was their joint effort.

2. A comparison with the Republic of China with more than three times the Indian budget for S&T is illuminating.

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and defence establishments. I take this opportunity to include the comments by Pradip K. Ghosh, who had also pointed out some technical corrections: ‘There is a bit of technical “shortcoming” when you say that we wished *to build* the world’s highest resolution optical spectrometer (because that was not the objective) – we *actually built* (to serve our research purpose) what we believe was *this country’s* highest resolution highest dispersion (dual dispersion) visible – UV scanning spectrometer (total 21 ft: the front part 7 ft, the rear part 14 ft). The resolution was limited by the grating used. By changing the grating in the same structure, the resolution could be increased. I do not know where that would fit in Ottawa NRC’s collection, but ours was a fine one in operation. But this “shortcoming” in no way matters on what you have said in the body of your write-up.’

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Response:

I thank Dasannacharya for his comments and in particular for pointing out that the nuclear explosions carried out in 1974 and 1998 were both joint efforts of DAE

Is the Scyphozoan jellyfish *Lychnorhiza malayensis* symbiotically associated with the crucifix crab *Charybdis feriatius*?

Scyphozoan jellyfish (Medusae), the gelatinous invertebrate group, plays a vital role in the global oceanic and coastal ecosystems. By virtue of their floating nature, and horizontal and vertical spread in the water column, they are known to have varied associations with other invertebrates and teleosts, which make them an integral part of the marine ecosystem. In general, studies on ecology and trophic links of jellyfish from Indian waters are scanty.

Regular research cruises ($n = 45$) in 2014 conducted by the Central Marine Fisheries Research Institute, Kochi, on-board *FRV Silver Pompano*, the Scyphozoan Rhizostomeae jellyfish *Lychnorhiza malayensis* were caught in the experimental trawl catches. *L. malayensis* has a wide distribution in the Malayan Archipelago and the Indian Ocean. During the

last century, Nair¹ has reported the presence of this species off the Thiruvananthapuram coast (Kerala) for a short period, from September to October during 1942 and 1943. In the present study, distribution range of *L. malayensis* was found to be extended from Thiruvananthapuram to Goa, inhabiting the depth zone 6–50 m and the period of occurrence was also prolonged from July to October. Jellyfish sampled ($n = 468$) were examined for identifying the associated animals attached to the body of these jellyfish. They were caught in large numbers in 16 hauls; the crucifix crab *Charybdis feriatius* was found to have a close facultative commensalism with these jellyfish.

The associations of jellyfish species with brachyuran crabs in global oceans have been reviewed² as well as those

with fishes³. However, the symbiotic association of *L. malayensis* with *C. feriatius* has not been reported earlier. *C. feriatius* was found associated with ($n = 65$) jellyfish. These associations were noticed only from August to October, with maximum in September.

C. feriatius associations were observed in the jellyfishes which were caught in 12–18 m depth. The bell diameter (BD) and wet weight of the jellyfish were measured. BD of *L. malayensis* ranged from 11 to 33 cm and wet weight from 150 to 1250 g. The crabs were found clinging onto the oral arms (tentacles) of the jellyfish (Figure 1). Correlation between the association of crabs with size and weight of the jellyfish could not be established. Most of the jellyfish harboured single adult specimen of *C. feriatius*, while few had two crabs. The



Figure 1. Commensalism of jellyfish *Lychnorhiza malayensis* with crucifix crab *Charybdis feriatius*.

carapace widths of the crabs were measured and ranged from 11 to 28 mm. Most of the small crabs (11–18 mm) were found clinging to the jellyfish oral arms in head downward position and few adults were in head upward position.

Maximum aggregation of *L. malayensis* near the seabed was observed during morning hours (0600–0900 hrs) and slowly the aggregation moved up to the middle of the water column by 1000–1100 hrs. *C. feriatius* generally found in the seabed were associated with jellyfish

during morning hours and transported to other pelagic environment during the daytime. It is presumed that the jellyfish provide shelter and protect the crabs from predators. Juveniles of the shrimp scad fish *Alepes djedaba* (12–42 mm length range) were also found to be associated with oral arms of *L. malayensis* and these may also form a feed for the crabs.

The jellyfish associated with crabs were brought to the laboratory and maintained in live condition in glass aquaria

filled with fresh seawater and their behaviour was observed. Laboratory observations showed that the crab was associated with jellyfish for the short period and moved out most of the time. This shows that the association of *C. feriatius* with *L. malayensis* is facultative commensalism.

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How reliable are the data on the recent coral bleaching event in Malvan Reef, India?

De *et al.*¹ have raised concerns about the possible impact on fishery and tourism due to a recent bleaching event in the patch reefs of Malvan, west coast of India. They followed the belt transect method to assess the extent of bleaching in 400 m² area. Hill and Wilkinson² report a method known as ‘bleaching belt transect’ to assess bleaching extent, which is similar to that adopted to study the Malvan reef bleaching event¹. The bleaching belt transect method integrates other survey methods such as rapid visual assessment (RVA) or line intercept transect (LIT), or point intercept transect (PIT) if the survey area is small². However the belt transect survey adopted to study bleaching in the Malvan reef¹ is commonly used for assessing fish and benthic invertebrate density². The study in the Malvan reef shows 15% corals are bleached¹, which does not portray a clear picture on the extent of bleaching in a

0.28 sq. km reef patch³ due to a low resolution method adopted.

Although methodologies in coral-reef monitoring are much debated and still yield similar results, based on specific needs, the appropriate method has to be selected⁴. Nevertheless, high-resolution data collected using PIT and LIT can be much more reliable in a small reef area like Malvan to study the extent of bleaching and severity, allowing better comparison with regional works^{5,6}. It may be useful for De *et al.*¹ to re-examine their data from a rather important data-deficient reef to aid scientists and managers in framing better management practices.

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