ISRS Statement on Global Coral Bleaching in 1997-1998

During 1997-98, reports of coral bleaching from all the major tropical oceans of the world suggested that this time period had seen the most geographically widespread bleaching ever recorded, with some areas (e.g., Singapore, and the Andaman Islands) witnessing extensive bleaching for the first time in recent history. Coral bleaching has been described in at least 32 countries and island nations in 1997-98; with reports from sites in the Pacific, Indian Ocean, Red Sea, Persian Gulf, Mediterranean and Caribbean recording widespread bleaching. The bleaching response represents a loss of symbiotic algae and/or their pigments such that the coral may pale in color to a varying extent, or turn starkly white. Paling of some coral species is an observed seasonal phenomenon in the Pacific, Indian Ocean, and also the Caribbean. Where bleaching is seasonal, or less severe, the likelihood of full recovery of pigmentation is high. In the present bleaching episode the response has been exceptionally severe with a large number of corals turning completely white and subsequently dying.

Mass bleaching normally occurs when seasonally maximal sea-surface temperatures (SST) are exceeded. The likely triggers of bleaching are elevated SST and solar radiation. Research has indicated that these factors act in combination, rather than alone. Additional causes of bleaching such as extreme low tides and reduced salinities have also been implicated at some sites in 1998.

The occurrence of bleaching at many locations has been patchy with more severe bleaching recorded in shallow waters than at deeper offshore sites. Not only hard and soft corals, but also sea anemones, zoanthids, giant clams, foraminifera and many other zooxanthellate invertebrates are affected by the loss of their symbiotic algae. Corals can recover from bleaching but death may result if environmental stressors are extreme and/or prolonged. In the Indo-Pacific fast-growing, branching corals are more susceptible to bleaching than slow-growing boulder corals, leading to a high mortality in the former. Recovery of boulder corals has been frequently recorded in 1998, often within 1-2 months of initial bleaching. In the Caribbean, however, greater bleaching-related mortality has been shown in boulder and plate-like corals rather than in branching species, which had already suffered extensive mortality from storms, diseases and terrestrial run-off. In the Indo-Pacific the susceptibility of different corals to bleaching can significantly affect coral community structure and diversity, depress the rate at which the reef builds up, and reduce habitat availability for other reef species. Previous cases of bleaching-induced mortality from 1993 in the Pulau Seribu (Java Sea) and from 1996 in the Similan Islands (eastern Indian Ocean) have provided examples of community change. At both sites shallow parts of the reef have been temporarily transformed from being a mixture of branching and boulder corals to areas in which virtually only the boulder corals survive. During the current 1998 bleaching, one reef on the Australian Great Barrier Reef has been so severely affected that even many of the robust boulder corals (one of them dated as over 700 years of age) were badly damaged or died. Complete recovery of reefs following severe bleaching is dependent on growth and fragmentation of remaining corals, and on recruitment from stocks in the area. Evidence shows that restoration of the reef to its former state may be slow or, if interrupted by man-made change, may even be halted altogether.

Links have been made between the widespread incidence of coral bleaching in 1997/98 with one of the strongest El Ninos of this century. While past and present coral bleaching events in many parts of the Pacific appear to be closely matched to El Nino-induced seawater warming, the connections are not clear-cut for all locations in the Pacific. Nor can bleaching in Indian and Atlantic waters be directly linked to only El Nino phenomena. Factors responsible for elevated SSTs in the Indian Ocean, for example, are likely to be the result of a complex product of El Nino-related, monsoonal and local oceanographic factors which are superimposed on interdecadal patterns in climate variability.

Links between the apparent changing nature and frequency of the El Nino phenomena and global climate change have also been made but are the subject of controversial debate among climatologists with many suggesting that present patterns reflect the natural variability of the system rather than the effects of greenhouse gas-induced warming. For some of the tropical oceans significant increases in SST have been observed over the last 50 years. Concerns about the potential effect of global change on future frequencies of severe bleaching events are based on the narrow upper margin of environmental tolerance in corals. While corals display impressive acclimation processes to changes in some environmental parameters, it is not known whether they are able to adapt or acclimatize at rates which match the projected rates of background seawater temperature increase. Should seawater temperatures rise, either as a result of greenhouse gas emissions or natural variability in the ocean/atmosphere system, then we might expect the incidence and severity of coral bleaching to increase yet further in the future with the possibility of substantial changes to the coral reef community structure.

The 1997-98 episode of worldwide bleaching is a major cause for concern. Although sea temperatures have returned to normal in many tropical areas of the world the full extent of bleaching-induced mortality may not be fully apparent for several months yet.