6 Sampling and Data Analysis

WG 12 discussed this topic very briefly, the major issue being skewed distributions resulting from aggregated populations and methods of dealing with them. We also discussed catchability experiments and improved more quantitative visual methods of surveying with submersibles, such as a LASER Line Scan System. A field guide to biological sampling and observation techniques (Jademec *et al.* 1999) has been developed by the University of Alaska that is an excellent protocol for the taking and coding of field observations of crabs in general.

6.1 Spatial structuring of crab and shrimp populations

Discussions were limited to well known stocks as examples of various processes and their effects rather than a systematic consideration for all stocks that we have identified. This was necessary due to the large number of stocks involved and the fragmentary information available for many of them. In general it appears that spatial structure is extremely important in the maintenance of recruitment for crab and shrimp stocks.

The existence of discrete aggregations at fine spatial scales are well known for many crab and shrimp stocks. At large spatial scales, meta-population structure is often perpetuated by larval drift, occasionally to the point that some geographical units may be non-functional from a reproductive standpoint. This may be true of snow crab in very cold portions of the northern Bering Sea where few reproductively active snow crab are found (Jewett 1981**,** Wolotira *et al.* 1977). The same larval drift may result in genetic interchange between populations in the Bering Sea and those in the Chukchi Sea (Paul *et al.* 1997).

Current patterns, and the adaptations of crab behaviour to them, re demonstrated by the Dungeness crab studies referred to above in the section on "Oceanography and recruitment". As suggested, it can be quite complex, meaning that to fully understand any species population dynamics, detailed studies will likely be required.

6.2 Effectiveness of marine sanctuaries and restrictions on fishing activities for crabs and shrimps

This topic was also briefly considered. There are apparently few marine sanctuaries that were established primarily to protect crabs and shrimps in the PICES Region. One exception is found in the northern portion of the West Kamchatka Shelf where red king crab nursery grounds are closed to both trawling and pot fishing. Those that might be useful in this regard protect habitat for a multiplicity of purposes (e.g. no dredging, dumping, mineral exploration, removal of artifacts, etc) other than perpetuation of adjacent fisheries by means of "no-take zones". This does not preclude establishing sanctuaries for this latter purpose, though, and we recognized that sanctuaries are being considered in management planning for a variety of fisheries. Most frequently, closures to fishing gear of certain types are used in the management of crabs and shrimps. Reasons for these latter "sanctuaries" are typically site-specific, and include allocation across sectors, bycatch minimization, minimization of sublegal species retention, navigation concerns, and efforts to control fleet capitalization.

WG 12 also noted that several areas are now closed to bottom trawling to protect crab stocks, and that various marine sanctuaries are being planned or proposed in the United States, Canada and Japan.

Finally, in Canada and the U.S. at least, seasonal protection of some crab stocks occurs, not though marine protected areas, but through fisheries regulations. These have been established to stop both crab fishing and trawling at seasonal times of crab molting (soft-shell condition) (see Jamieson and Lessard 2000 for Canadian examples).