3 WHEN TO USE VPA

VPA methods require age-structured data, and, in general, VPA-type methods are always preferable when age-structured data are available. Catch-at-age data are usually derived from large scale size frequency sampling, and smaller scale age sampling to provide age-length keys (ALK). Age-length keys can be obtained, but less reliably from growth models, but in either case, size and age need to be linked through models. Alternatively, the age distribution can be obtained directly by sampling the catches and ageing the entire sample, although often it is difficult to get good coverage at low cost using this approach.

The catch in number of fish and mean weights are usually derived from total yield (catch in weight) data from a fisheries statistics programme and biological samples taken from these catches. The biological data provide the mean weight of individuals, which can be used to convert weight to numbers. The age composition of the catch can be obtained from age-length keys or aged random samples of the catches.

The VPA model was built on the assumption that there is one cohort per year. This is not a serious restriction, but the model needs modifications when there are several cohorts per year. The usual difficulty in dealing with more than one cohort per year is the lack of methods to allocate fish to their correct cohort. There are examples when there is no cohort structure in the population because the fish stock is spawning continuously. The population model applicable in such a situation differs from that presented in this manual.

The general data model includes the following elements, but only rarely are all elements available for a particular assessment.

- Total catch in number by age and year.

- Abundance estimates in absolute terms, each index representing one or several age groups (e.g. acoustic survey abundance estimates).

- Abundance indices, each index representing one or several age groups (e.g. bottom trawl CPUE from research vessel surveys).

- Biomass indices, typically representing several age groups (e.g. spawning stock biomass indices from egg or larvae surveys).

- Effort indices, typically representing the partial fishing mortality on a group of age classes (e.g. effort data from a fisheries statistics logbook programme).

- Mean weights by age and by year corresponding to the catch. These data are not used in the stock estimation procedure that is directed towards obtaining stock in numbers by age and by year. The mean weights are, however, used in projections of the yield under different scenarios.

The following three data types are required for calculation of the spawning stock biomass:

- Mean weights by age and by year corresponding to the spawning stock
- Maturity ogive (fraction of the population which are mature) by age and by year
- Fractions of the mortality prior to spawning

The total catch data take a special role in this model. While some of all the other elements may be missing, this is not the case with the catch-at-age and year data. These data must be available for the methods presented in this manual to be applicable. In Section 7.4 methods dealing with missing values in the catch-at-age and year data matrix are considered.

Natural mortality is only rarely estimated using VPA. Vetter (1988) reviewed methods to obtain the natural mortality. The parameter can in some cases be estimated from the types of data discussed in this manual. However, experience has shown that where such estimates can be obtained, they have very large confidence limits and are therefore not considered useful.

Useful information on natural mortality can be obtained through the Multispecies VPA technique (Sparre 1991, Magnusson 1995, Section 4.8). Here the standard data model is extended with data on stomach contents from fish caught at sea and with data from laboratory experiments, providing estimates of annual prey consumption.