Abstract. Conservation of marine mammals as currently practiced protects populations roughly in proportion to the extent they are reduced. The status of a population is expressed in terms of the population level as a fraction of the mean of natural (undisturbed ecosystem) equilibrium level. This approach requires estimates of: (1) current population level, and (2) carrying capacity of the undisturbed habitat. Implementation of this approach is fraught with practical problems: population levels are difficult and costly to estimate and current carrying capacity is essentially impossible to measure through environmental assessment. The historic or natural carrying capacity of disturbed ecosystems can not be directly assessed. When possible, estimates of historic population levels are used as surrogates for the natural equilibrium population levels. Despite difficulties with implementation, no alternatives have arisen to replace this paradigm for marine mammal conservation. Following a review of the history, utility, and potential of indirect methods for population assessment, we suggest that characteristics of populations, and the individuals within, give a better assessment of ecosystem conditions and relationships than can be achieved through direct measurement. This approach assumes that animals in the population are the best integrated expression of their environment. In this regard, some species serve as indicators of trophic relationships and ecosystem state. In wildlife management, various indices of population status have been proposed or used. In particular, measures of biological features that experience density-dependent change provide indirect means of determining population status. We review literature on the use of physiological condition, measurements of size and growth rates of body parts, and the components of population dynamics (e.g., reproductive rates, survival, age at maturation) as indicators of the status of populations. Care must be taken to choose indices that reflect integration over sufficient time to avoid variation due to momentary conditions, such as annual weather cycles. Knowledge of the relationship between population status and the magnitude of the biological feature is necessary. Although this approach involves inherent problems, there also are advantages.
Often data can be collected easily, and they usually reflect current environmental conditions for assessing human-induced changes in the environment.

INTRODUCTION

Wildlife management in general, and marine mammal management in particular, depends on criteria for evaluating population status to determine the need for protection. Based on the principles of population dynamics, one reference point is the mean naturally occurring (i.e., in the absence of perturbations by other than aboriginal human activities) population level, often referred to as carrying capacity \( K \). The mean is used to account for natural fluctuations. As populations are reduced below \( K \) there is increasing justification for providing protection. If there is evidence that current \( K \) is less than historic or natural \( K \), and the change is due to anthropogenic influence, there is a basis for management to restore the ecosystem. Hereafter, the historic carrying capacity will be called "natural \( K \)”, the current carrying capacity "current \( K \)”, and a current \( K \) that is different from natural \( K \) an "altered \( K \)".

Another reference point for population status is that population level which, on average, results in the most rapid population growth. This point, often referred to for marine mammals as the maximum net productivity level (MNPL), was derived from the concept of maximum sustained yield (MSY), from fisheries management. In marine mammal policy, populations above MNPL may be harvested (or subjected to other forms of human-induced mortality); below this level they are afforded more protection.

One of the shortcomings of management based on single-species approaches is the failure to account for environmental changes (either natural or human induced). Such problems would occur in the case of managing two competing (or predator and prey) species simultaneously. Ill-advised management decisions might occur if \( K \) experiences extensive long term (but natural) trends. Using single-species approaches, failure to recognize anthropogenically damaged ecosystems may result in not recognizing the need to restore ecosystems. The problem of how to measure \( K \) in such single-species approaches is not often addressed.

For marine mammals, the paradigm described above is embodied in the United States’ Marine Mammal Protection Act (MMPA, P.L. 92-522, 21 October 1972). The points of reference in implementing the MMPA, in a single-species context, are \( K \) and MNPL (where MNPL is also the lower bound for the optimum sustainable population, OSP). To deal with interactions with other elements of the biotic environment, the MMPA requires that populations be managed with consideration of the "health and stability of the marine ecosystem." Yet criteria for multispecies aspects of management are vague and undefined.

Internationally, similar single-species approaches to management are typical. Under terms of the International Whaling Commission (IWC), cetaceans are managed with more protection provided for increasingly reduced populations. In this case, reference points include the population level at maximum sustained yield (IWC 1977). Under the Convention of the Conservation of Antarctic Marine Living Resources