CHAPTER 10

RESTORATION TECHNIQUES: ASSUMPTIONS AND DEFICIENCIES

ASSUMPTIONS

All seabird restoration techniques are based on assumptions about seabird biology or the supporting marine and terrestrial environments. Managers using any restoration technique must assume that demographic parameters can be manipulated though human intervention and that such interventions will benefit the population. *Each technique requires the manager to assume that constraints on the demographic factor being manipulated are restricting the population's rate of growth and that manipulations removing the constraints will significantly increase population growth.* The attractiveness (i.e., potential for success) of any technique to seabird managers is related to the degree to which the underlying assumptions can be supported by scientific evidence or the technique's history of success.

DEFICIENCIES

When judging the utility of any restoration technique or when comparing techniques, deficiencies associated with each technique need to be considered. Deficiencies that will act to lessen the appeal of any technique include:

1. high financial costs
2. excessive or extended labor or logistics
3. continuing enforcement
4. stakeholder resistance
5. potential public or political opposition
6. potential negative impacts on ecosystem or nontarget species
7. low probability of success

Other deficiencies include uncertainty about the utility of a technique, difficulty in determining the success of the technique, and minimal changes in the parameter being modified. The deficiencies listed above are typically situation-specific. For instance, predator control might meet major opposition in an urban area but could be conducted with little opposition in less populated areas. However, if predator control were exceedingly costly or logistically unfeasible, the technique might be abandoned regardless of location.

TECHNIQUE-SPECIFIC ASSUMPTIONS AND DEFICIENCIES

There are three demographic parameters that can be manipulated to restore seabird populations: recruitment of nonbreeders into the breeding population, breeding productivity, and survival. We discuss below the assumptions and deficiencies associated with manipulating each of these parameters. Deficiencies associated with specific techniques are presented in Table 2 (in Chapter 2) and in those sections of this report discussing techniques.

Recruitment-Enhancing Techniques

Assumptions

Recruitment-enhancing techniques presuppose the existence of a pool of nonbreeders, some of which would be recruited only if biologists employ the restoration techniques. They also assume that these birds will be of greater benefit to the population if recruited to the target location than if recruited elsewhere. Deferred maturity is common in seabirds, with age at first breeding for a species dependent on evolutionary, local, or annual conditions (Ashmole 1971, Lack 1967). Techniques that encourage recruitment could act to influence birds to breed at a younger than normal age. Additionally, encouraging recruitment could also increase rates of immigration since immature birds disperse more widely than adults and since nonbreeders commonly visit nonnatal colonies (Harris 1983, Halley and Harris 1993). These techniques also require managers to assume that prey availability or other factors are not restricting recruitment.

Deficiencies

As a group, recruitment-enhancing techniques have a major problem: a pool of surplus nonbreeders is not always present. Populations depleted by an oil spill and not naturally recovering, or having a low probability of recovering, may not have a large pool of nonbreeders needing encouragement to reproduce. Timing of the spill-related mortality could affect the size of the pool of potential recruits. If the mortality affected all age classes (as might be the case for a fall or winter spill), the pool of nonbreeders would also be reduced. If the mortality involved primarily breeding adults (as might be the case for a spring or summer spill) and breeding productivity in the years immediately preceding the spill was high, a substantial pool of nonbreeders could be expected to be present. In this latter case, however, postspill recruitment would be expected to be naturally high, especially if the prespill population had been nest-site limited.

Recruitment-enhancing techniques may also entice birds to attempt to reproduce at locations that may not be able to support a population or a larger population. For example, recruitment-enhancing techniques would not be effective, or may even be detrimental to a population, if they are attempted at breeding sites that are already food or nest-site limited. Recruitment-enhancing

techniques may also reduce numbers at source colonies if the birds recruited to the restoration constitute a significant fraction of nearby healthy colonies.

Productivity-Enhancing Techniques

Assumptions

Restoration techniques that increase breeding productivity have the benefit of acting on birds remaining in the population after a spill-related mortality has occurred. They assume, however, that human activities can have a measurable and substantial effect on hatching and fledging success. There is little information to support this assumption for seabirds. Use of restoration techniques that attempt to increase productivity assumes that factors affecting postfledging survival are not density-dependent and that postfledging mortality will not increase with increased fledging success.

However, several techniques whose principal effect is to act on recruitment or survivorship can also secondarily increase breeding success. Thus, the principal effect of predator eradication may be to increase recruitment, but a secondary effect is to increase the breeding productivity of the entire population.

Deficiencies

The principal deficiency associated with productivity-enhancing techniques is the lack of evidence that humans can influence breeding success sufficiently to achieve significant population restoration. It is difficult to establish the success of these techniques. Annual variation in breeding productivity can be high and may be influenced by various factors (such as a warm-water event or other oceanographic or climatic conditions) that could mask the effects of any restoration technique. Additionally, low survival of prebreeding birds can offset any changes in fledging success.

Mortality-Reducing Techniques

Assumptions

When sources of mortality for adult birds are known, especially if the sources are anthropogenic, managers can reduce or control them as part of a restoration plan. Techniques that attempt to reduce mortality assume that the mortality is additive and that the population is not nest-site or food limited. Mortality-reducing techniques have an advantage over other techniques because they act directly on the most critical segment of the population.

Deficiencies

Mortality-reducing techniques have fewer generic deficiencies than either recruitment- or productivity-enhancing techniques. If successful, they act directly on breeding population size. However, some techniques may meet with stakeholder or public resistance regardless of efficacy; these include reducing subsistence harvests of seabirds and removing introduced species (e.g., foxes). Some techniques, such as reducing chronic pollution, are hard to monitor.

SITUATION-SPECIFIC CIRCUMSTANCES

The potential utility of a technique in restoring a population depends on the status of the injured population, the nature and magnitude of the injury, the reason for the lack of natural recovery, and the carrying-capacity limitations of the ecosystem. Prespill research, including baseline monitoring and studies of breeding and feeding ecology, may provide information on which factors have limited population growth in the past and the ability of the population to recover from decreases. This information is important, not only in ascertaining the need for active restoration, but also in selecting the class of restoration techniques that is most appropriate. For example, if breeding success was low in the years immediately preceding a spill-related mortality, the use of techniques that seek to increase recruitment may be impractical. Similarly, if a population was nest-site limited in the past and oil spill mortality reduced the breeding population, providing nest sites at the depleted colonies, by itself, would be unnecessary because many prespill nest sites could be expected to be vacant.

The quality of the pre- and postspill data and the rigor of the analysis of those data needs to be considered. Preliminary data analysis suggested that delayed phenology and lack of synchrony occurred in the three breeding seasons following EVOS. Although common murre breeding did appear delayed in 1989-91, compared with prespill years, by 1993 at colonies on the Barren Islands and Puale Bay, breeding phenology and productivity appeared to have returned to normal (Boersma *et al.* 1995, Piatt and Anderson 1996). Any hasty attempts to influence synchrony and phenology at these colonies would have been a waste of funds, and the Trustee Council was correct in rejecting such attempts.