

General introduction

Since the advent of agriculture wild birds have been regarded as pests of agricultural production, primarily by consuming produce either during the pre-harvest or post-harvest period, or both (Pope & Irving 1976; Akande 1982; Ruelle & Bruggers 1982; Bomford 1992; Watkins *et al.* 2000). However, programmes aimed at developing strategies to reduce or eliminate crop damage have a poor record of success (Wright 1982; Jarvis 1990; Watkins *et al.* 2000). Quite often growers use ineffective bird control techniques, with little or no net benefit in terms of a reduction in bird damage (Boyce *et al.* 1999). Bird control strategies have traditionally been directed at either (1) deterring or repelling birds from crops (by chemical, visual, and audible means), (2) preventing birds from reaching crops with physical barriers such as netting, (3) reducing the population of problem birds through direct persecution or (4) reducing food resources. However, where reduction in crop damage is achieved successfully, this is generally of a temporary nature as birds are able to adapt quickly to repellents, or recover population losses through influxes from adjacent areas or by increased natality (Heyl 1986). Despite the availability of numerous control methods, the problem of bird damage still remains largely unresolved today, with a definite need for better methods of damage reduction and bird control.

The extent of damage caused by birds to crops of varying types is often significant (Dyer 1975; Henne *et al.* 1979; Mundy 1980; Akande 1982; Jarvis & le Grange 1982; Elliott 1989), with grapes being no exception (Rowan 1966; Hothem & DeHaven 1982; Rooke 1984; Myburgh & Jarvis 1986; Jarvis & Heyl 1990a; Watkins 1999; Somers & Morris 2002) often resulting in large financial losses annually (Hothem & DeHaven 1982; Heyl 1986; Jarvis 1990; Sinclair 2000; Watkins *et al.* 2000). Birds damage grape crops by either pecking or consuming whole grapes from bunches. The former feeding method causes secondary spoilage as bacteria, moulds and insects attack the damaged berries, which may ruin an entire bunch (Myburgh & Jarvis 1986). In the table grape industry, where bunch appearance is an important feature of the produce, even minimal feeding by birds can cause cosmetic damage that results in the fruit being unsuitable for export, thus further reducing the economic value of the harvest. Despite extensive damage to grape crops, quantitative methods of assessing bird damage remain poorly developed (DeHaven & Hothem 1979; Heyl 1986; Porter *et al.* 1994), while growers' subjective estimates are often unreliable for accurate cost-benefit analyses. More recently, however, advances have been made towards developing an objective damage assessment technique for grape vineyards (Tracey *et al.* 2001; Tracey *et al.* in press).

In South Africa there has been a dramatic expansion of the table grape export industry over the past 15 years, most notably in the Orange River valley where high summer temperatures and low rainfall favour the production of grapes (De Villiers & Du Plessis 1997). Bird damage to table grapes in this region has been estimated to amount to millions of rands per annum (D. van Zyl pers. comm.), with the earliest-ripening grape cultivars experiencing the most severe damages. These varieties in particular have only recently been introduced to the region and because they ripen earlier than the existing varieties, they have a higher market value. This prompted a request by the Orange River Producers Alliance (ORPA) during late-2000 to the then Northern Cape Nature Conservation Service (now Northern Cape Directorate of Conservation) to assist with an investigation of the problem of bird damage along the Orange River. Information was required about the economic value of the losses and an assessment of the present damage-mitigating strategies.

Elsewhere in South Africa several bird species cause damage to grapes (Siegfried 1967; Rowan 1970; Jarvis 1985; Myburgh & Jarvis 1986); however, no studies in this regard have been conducted in the Orange River valley. Provision is made in the Cape Province Nature & Environmental Conservation Ordinance (No. 19 of 1974) and the Northern Cape Directorate of Conservation's annual hunting proclamations for the control of problem birds in vineyards. A variety of control methods aimed at reducing bird populations are used by grape producers in the Orange River valley, including mist-netting and cage-trapping, as well as non-lethal methods such as carbide guns and visual scaring devices. Quite often growers use extreme measures to protect their crops, such as covering individual bunches with protective bags or netting, but this is generally considered to be an expensive and time-consuming option. Although numerous control methods have been suggested and evaluated over the years, the general conclusion is that a combination of management practices is required to reduce damage (Hothem & DeHaven 1982; Jarvis & Heyl 1990a; Jarvis 1991; Sinclair 2000).

In addition to the complexities of different crop protection measures, European import standards are continually becoming more stringent with EurepGAP providing international verification frameworks over a wide range of agricultural-production sectors. The EurepGAP protocol sets minimum standards for all aspects of agricultural enterprises and produce, including, among others, crop protection and environmental management. The implication that this holds for the table grape grower is that traditional crop protection measures, particularly those involving lethal control, may no longer be regarded as ecologically and ethically acceptable. Producers may therefore be faced with fewer options to control bird damage, while still having to meet the demands of the market in terms of the quality and quantity of exportable grape bunches. It has however been recognised by a number of studies (e.g. Wright 1982; Rooke 1984) that efforts at reducing bird populations are generally ineffective in reducing crop damages to acceptable levels, and that an ecological approach offers the only potential long-term solution. Weatherhead (1982) recognised three basic steps in the process to solve a pest problem. Firstly, the severity of the problem needs to be determined, which can be achieved by developing methods for assessing the problem, such as accurate damage assessments. Secondly, a comprehensive understanding of the species involved must be developed, particularly with respect to those features of its behaviour and ecology that are the causal factors in the conflict situation. Finally, an attempt can then be made to devise cost-effective management strategies by integrating the understanding gained from the preceding two steps. Taking these steps into consideration, the key questions of this research were as follows:

1. Which bird species are causing damage to table grapes?
2. What is the extent of this damage and its economic implications?
3. How does the presence of grape crops affect the species composition and abundance of birds in vineyards and adjacent native habitats?
4. What control methods are currently being used and how effective are they?
5. Are there ecologically sound management options available to growers to protect their crops, and how should these be implemented?

To accommodate these objectives in a structured manner, this report has been divided into a number of chapters with each section dealing with separate aspects. Some of the chapters have been written in a basic format for submission to both agricultural and ornithological journals, either as full papers or as short notes. Hence there may be repetition of some sections throughout the report. The chapter that follows this introduction deals with the study area (Chapter 2), giving

a detailed description of the Orange River valley in terms of topography, vegetation, regional avifauna, as well as the areas and farms covered during the project. Chapter 3 (written as a full paper) deals with the quantification of bird damage to table grapes in the region, providing a detailed description of the method used to assess damage, the results of damage levels between the various grape varieties and a discussion of damage trends related to various environmental variables. The trends in species abundance and density of problem birds during the grape-harvesting season in vineyards and native habitats are discussed in Chapter 4 (written as a full paper for publication in an ornithological journal). Chapter 5 (written as short paper) gives an overview of the behaviour of different bird species in vineyards and particularly those species that are responsible for damage to grapes. In Chapter 6, also written as short paper, the various control methods that are currently being used by growers in the region are evaluated, both in terms of their effectiveness and the costs involved in maintaining these on an annual basis. New bird-deterring devices that are available on the market, but that have not yet been field-tested are also included in the cost analysis. The short- and long-term financial implications of each method are evaluated. The results of the questionnaire survey of a representative sample of growers in the region is summarised in Chapter 7. This provides an overview of the perceptions and experiences of growers regarding various aspects of grape damage. The recommendations follow in the final chapter (Chapter 8), which discusses a selected array of available and potential control methods and their effectiveness for deterring birds from vineyards in the region.