CENTRE FOR
SOCIAL SCIENCE RESEARCH

Social Surveys Unit

SURVEY OF BEEKEEPING IN SOUTH AFRICA

Beatrice Conradie
Bronwyn Nortjé

CSSR Working Paper No. 221

July 2008

Beatrice Conradie is a senior lecturer in the School of Economics at University of Cape Town and Bronwyn Nortjé is a graduate student in politics with an interest in policy formation.

Survey of beekeeping in South Africa

Introduction

The Marketing of Agricultural Products Act (47 of 1996) provides for a range of statutory measures given that a Section 7 committee of the NAMC (National Agricultural Marketing Council) can be convinced that these measures would improve market access for all and the overall efficiency of the market. Such an investigation was requested in 2006 and completed in early 2008 (NAMC, 2008). Being allowed to collect a levy is the key benefit of statutory measures, which also includes registration and records and returns, but before any industry qualifies for statutory measures, it must convince Government that it a) has the support of all stakeholders and b) exactly know the extent of the industry. This survey is the first national survey of beekeepers in fourteen years and an important response to the NAMC recommendations towards qualifying for a statutory levy.

So, how many bees are there?

According to Allsopp & Cherry (2004), commercial beekeeping was enabled in South Africa as a result of the widespread local planting of Eucalypts during the mid-19th century. The data that are currently available on the industry are summarised in Figure 1, which was updated from Fletcher & Johannsmeier (1978). We have reasonably good data from when the first farm census was taken in 1911, up until 1988. For most of that period we see approximately 60 000 domesticated honey bee colonies producing about 500 tons of honey, i.e. 8.3 kilograms of honey per hive per annum. During 1974/5 a special bee census was taken by the Apiarian section of the Department of Agricultural Technical services (Fletcher & Johannsmeier, 1978). It still recorded approximately 60 000 colonies, but for the first time a total honey crop of 2000 tons, or an annual average yield of 24 kilograms per hive, was recorded. This represented a significant increase over the farm census data.

Although the 1988 farm census did not record bee colonies, it still reported a total honey crop of about 1300 tons, which confirms the yield data from the 1974/5 bee census. No representative data exists for the next fourteen years, until in 2002 when the farm census again recorded honey production. According to the 2002 census, the national honey crop amounts to 412 tons per year, which

is similar to pre-1988 levels. It is well-known that the 2002 census suffered serious non-response problems. For example, when we compare the 1988 and 2002 farm censuses, the data suggests that the area under wine grapes shrunk by 26% when according to the Wine Industry Information System wine grapes expanded by 19% over this period. This discrepancy suggests underreporting of about 45% in the 2002 farm census. Similarly, the area under lucerne was reported to have 'shrunk' by 45%, from 233 000 hectares in 1988 to 129 000 hectares in 2002. When we adjust the recorded honey crop for the 2002 census' non-response problem, it increases the estimate to approximately 650 tons. This is still low compared to 1974/5 and 1988 estimates.

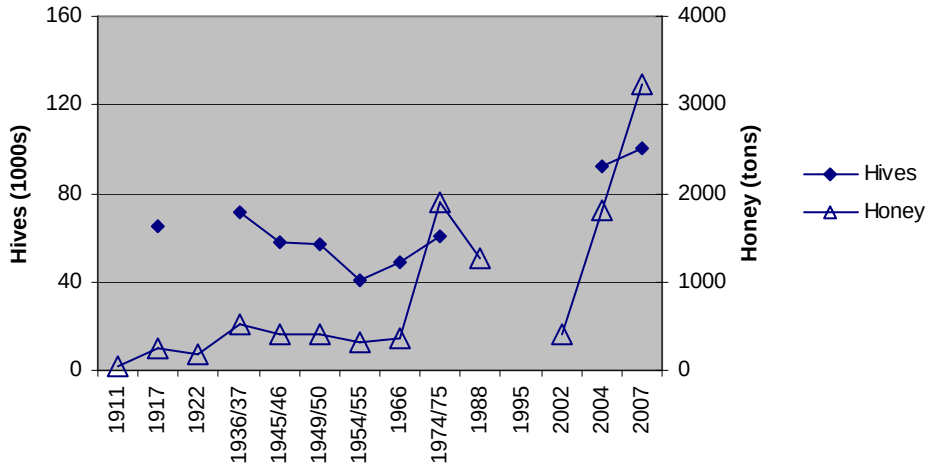

Figure 1: Honey production (tons) and hives (1000's)

Fortunately, Allsopp & Cherry (2004) were able to produce a detailed dataset for the Western Cape as a result of the 2000 gum survey. They report 34 000 colonies for the Western Cape, which they conclude to be 80% of all hives in the province. Their average reported yield is very low, at just 13.4 kilograms per hive. They attribute this to overcrowding of available forage and the management of hives to provide pollination services rather than produce honey.

Converting Allsopp & Cherry's (2004) data to a national estimate requires some guesswork about the importance of the Western Cape in the national production. There are three competing estimates. The most recent is SABIO's assessment that 29% of national honey production and 46% of all beekeepers are in the Western Cape. SABIO's estimate of the Western Cape's share of honey is remarkably similar to that of the 1988 farm census which places the Western Cape's (development region A) share of honey at 25% of national production. The 1974/5 survey achieved a 40% response rate and included 271 Western Cape beekeepers with 15 650 colonies (Allsopp & Cherry, 2004). The response

rate implies a total bee population of 39 125 colonies for the Western Cape, which compared to the national estimate of 60 389 (Fletcher & Johannsmeier, 1978), implies that the Western Cape supported 65% of domesticated honey bees in the mid 1970s. The truth is probably somewhere between the reported high and low estimates; a lower estimate for the Western Cape's share will produce a larger national estimate and vice versa.

If 34 000 colonies comprise 80% of the Western Cape's domesticated bee population (Allsopp & Cherry, 2004), and the Western Cape has 46% of the country's beekeepers (1988 farm census), it is possible that South Africa had 92 000 hives in 2004. Argued from the honey side, 454 tons of honey in the Western Cape, converts to a national honey crop of about 1800 tons. The estimate of hives is on the low side of SABIO's gut feeling, which puts the total number of hives somewhere between 90 000 and 110 000 colonies, and at about two thirds of what SABIO believes national honey production to be.

Allsopp & Cherry's (2004) careful validation of their sample made an important contribution, namely that there is every reason to believe that the industry might not be as large as we thought. Their best guess about the size of the industry in the province is 173 responses plus 113 known beekeepers who refuse to participate plus an estimated 30 small operators whose hives they came across in their validation process. Their total of 316 beekeepers is just 40% of SABIO's estimate. This point will be picked up in the final section when we try to estimate a national honey bee population from the 2008 UCT survey.

The 2008 survey

The UCT survey was conducted by post in April 2008. Its purpose was to produce a national estimate of commercial and hobbyist beekeeping to inform an analysis of the optimal organisation structure of the industry.

Given that SABIO is the official industry representative, we used its membership lists to construct a sampling frame. Questionnaires and self-addressed stamped envelopes (to UCT) were mailed to 500 beekeepers. The questionnaire was administered both in Afrikaans and English according to the language preference of each individual as lodged with the SABIO office. Several requests were made on chatgroups for beekeepers to respond to the survey, but no formal and systematic follow-up was conducted.

The response rate was 22.4% by the end of June 2008, which is somewhat higher than the 19.05% response rate received by Allsopp & Cherry (2004)

although substantially lower than the 40.4% recorded by Fletcher & Johannsmeier (1978). One questionnaire was returned blank due to an incorrect address. Only one respondent omitted geographical information and less than five percent declined to answer the very sensitive income question. Confidentiality was guaranteed in the cover letter as the survey was never meant to identify respondents, but a surprising two-thirds of respondents chose to identify themselves with a return address!

Using geographical distribution as a test of validity, the sample appears consistent with SABIO's estimate of the distribution of beekeepers in the country. See Figure 2. The main beekeeping provinces are Western Cape (including the very important Southern Cape), KZN and Gauteng, which account for 75% of the observations. The remaining 25% is distributed about equally across the rest of the region. The last column in Table 1 expresses the sample as a proportion of the estimated total beekeepers in each province. The average for the sample as a whole is 6%, with Free State and North West being somewhat underrepresented and Limpopo and the Northern Cape being somewhat overrepresented.

Table 1: Provincial breakdown of 2008 sample of beekeepers

	Survey	**SABIO's estimated total**	**Sample as % of total**
Eastern Cape	5	60	8%
Free State	4	100	4%
Gauteng	19	400	5%
KZN	11	130	8%
Limpopo	6	60	10%
Mpumalanga	4	80	5%
North West	2	100	2%
Northern Cape	6	60	10%
Western Cape	54	800	7%
Missing	1	-	-
Total	112	1790	6%

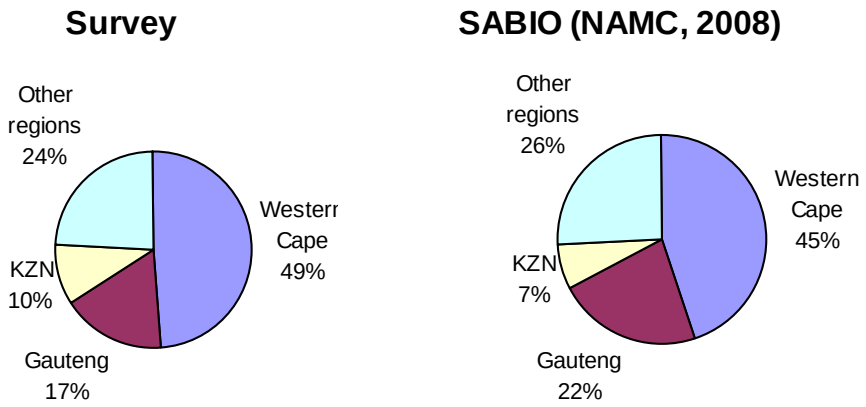

Figure 2: Distribution of beekeepers

The survey questions were grouped in four sections, namely size, location and marketing strategy, general production, specific production, and additional information. Very few of the 52 questions were open-ended. The descriptive statistics are reported by section below.

Size distribution & income from bees

It is well known that world-wide many beekeepers are part-time operators or retired people who manage a few colonies from which they derive a relatively small proportion of their income, if any at all. There is reason to believe that the same might be the case in South Africa, but it is not clear exactly what the hobby / commercial split is.

We asked respondents to assign themselves to one of five size classes based on the number of hives they manage. For interval data, such as this, it is customary to multiply the number of responses by the midpoints of the middle size categories and the upper end of the first category and lower end of the last category. Mistakes are clearly made on the large as well as the small end, however these errors generally cancel out. This procedure allowed us to report an estimated number of hives own by each size class of beekeepers. In the bottom part of Table 2 we give the average number of apiary sites used as reported by respondents. In each case the percentage represented by the size class is reported below the estimate.

Table 2: Responses, hives and apiary sites by size of operation

	Hives managed				
Size	**< 30**	**30 – 100**	**101 – 300**	**301 – 750**	**> 750**
Responses	44 (39%)	30 (27%)	19 (17%)	8 (7%)	11 (10%)
Avg. hives	30	65	200	525	750
Estimated hives	1320 (7%)	1950 (10%)	3800 (19%)	4200 (22%)	8250 (42%)
Avg. apiaries	2.3	5.2	23.1	32.1	103.7
Total apiaries	101 (5%)	156 (7%)	439 (21%)	257 (12%)	1141 (54%)

The sample consists of 112 respondents who manage an estimated total of 19 520 hives at 2 094 apiary sites. The smallest beekeepers, those with less than thirty hives each, comprise 39% of the sample, but control only 7% of the hives and 5% of the apiary sites in the sample. The very largest beekeepers, who each own more than 750 hives, are only 10% of the sample on a headcount basis, but manage 42% of the hives and 54% of the apiary sites in the sample.

The size classes used in Table 2 are slightly different from those used by Allsopp & Cherry (2004), but the distribution is quite similar. According to Allsopp & Cherry (2004) just under half (45%) of beekeepers in the Western Cape manage less than 50 hives each, but in total only manage 4% of all domesticated bee colonies. On the large side, they report that beekeepers with more than 250 hives each are 21% of the respondents and that they control 75% of the hives. Our results indicate that 19% of the respondents and 66% of apiary sites in categories 4 and 5, that is above 300 hives each.

Share of income from bees

In Table 3 we cross tabulate size (in hives) with respondents' reported share of income derived from bees. Hierarchical clustering techniques (Hair et al, 2006) produced three income groups, namely those who derive less than 25% from bees, those who get from 40 to 55% of their income from bees, and those who get more than 70% of their income from bees. One in three respondents told us that they get no income from bees and an additional one in four that they get less than a quarter of their income from bees. These individuals keep small

apiaries: More than half the respondents in column 1 have less than thirty hives and 89% of them have a hundred hives or less. On the other extreme 20% of respondents derives 70% or more of their income from bees. Nine out of ten of these beekeepers have more than a hundred hives and 71% more than 750 hives.

Table 3: Responses by size and share of income from bees

	Share of income derived from bees		
Size of operation	**< 25%**	**40 – 55%**	**>70%**
< 30 colonies	40	–	1
30 – 100 colonies	28	–	1
101 – 300 colonies	6	6	7
301 – 750 colonies	2	1	4
> 750 colonies	–	1	10
Total	76	8	23

For the two end groups, the traditional hobby/commercial cut-off of a hundred hives fits very well, but leaves an awkward middle group of which 75% falls in the category 101 to 300 hives. Hierarchical clustering with respect to income suggests that the middle income group is more similar to small beekeepers that to large beekeepers. If one combines the two smaller income groups, a hundred hives is still a good threshold to distinguish large professional from smaller more hobbyist beekeepers since more than 80% of those deriving less than 55% of their income from bees also keep a hundred hives or less.

Commercial pollination

The likelihood of offering pollination services is a function of both size and location. Only 30% of small beekeepers offer any kind of commercial pollination service, and only about half of those (i.e. 14%) are regularly involved with pollination. In contrast, 60% of large beekeepers rent out hives for pollination, almost all of them regularly. Large beekeepers own 99% of the hives used regularly in pollination and half of those used occasionally for commercial pollination. In the Western Cape 'medium' beekeepers (50 – 250 hives) play a more important role in pollination, providing about 10% of the service (Allsopp & Cherry, 2004). Regionally, the Western Cape has the highest proportion of beekeepers who regularly offer commercial pollination services (33%), but other (than the three main) regions have the largest incidence of all commercial pollinators. This suggests that the pollination industry has been

consolidated where there is a large demand for pollination, and consequently supports the claim that pollination income is what keeps beekeepers going. The effect of pollination on yield appears in Table 7 below.

Table 4: Respondents offering pollination services by size and region

	Commercial pollination services		
Size/ region	**Never**	**Occasionally**	**Regularly**
Small (≤ 100 hives)	58	14	12
Large (> 100 hives)	9	1	13
Total	67	15	25
Gauteng	14	4	1
KZN	7	2	2
Western Cape	34	2	18
Other regions	16	7	5
Total	71	15	26

We did not collect data on pollination income or the relative profitability of doing pollination compared to specialising in honey production, but we did ask if respondents knew the cost of honey production and the cost of providing pollination. Just under half of respondents indicated that they knew the cost of honey production, while two-thirds of those doing pollination indicated that they knew the costs associated with providing pollination.

Forage

Allsopp & Cherry (2004) established that two thirds of the honey produced in the Western Cape derived from Eucalypts, compared to only 18% from fynbos. In our results 68% of the apiary sites reported on by small beekeepers are located in the vicinity of blue gums while 72% of apiary sites kept by large beekeepers have Eucalypts nearby. Comparing the Western Cape with the rest of the country, large beekeepers outside the Western Cape are slightly, but not significantly, more dependent on Eucalypts while small beekeepers seem to make less (but not significantly less) use of blue gums than their colleagues in the Western Cape.

Fletcher & Johannsmeier's (1978) presented an overview of available bee forage, which was updated in Figure 3 from the Abstract of Agricultural Statistics (NDA, 2007) and Forestry South Africa (2006). The area under melliferous crops has been virtually constant since the late 1970s and fruit trees are relatively small compared to sunflowers and Eucalypts.

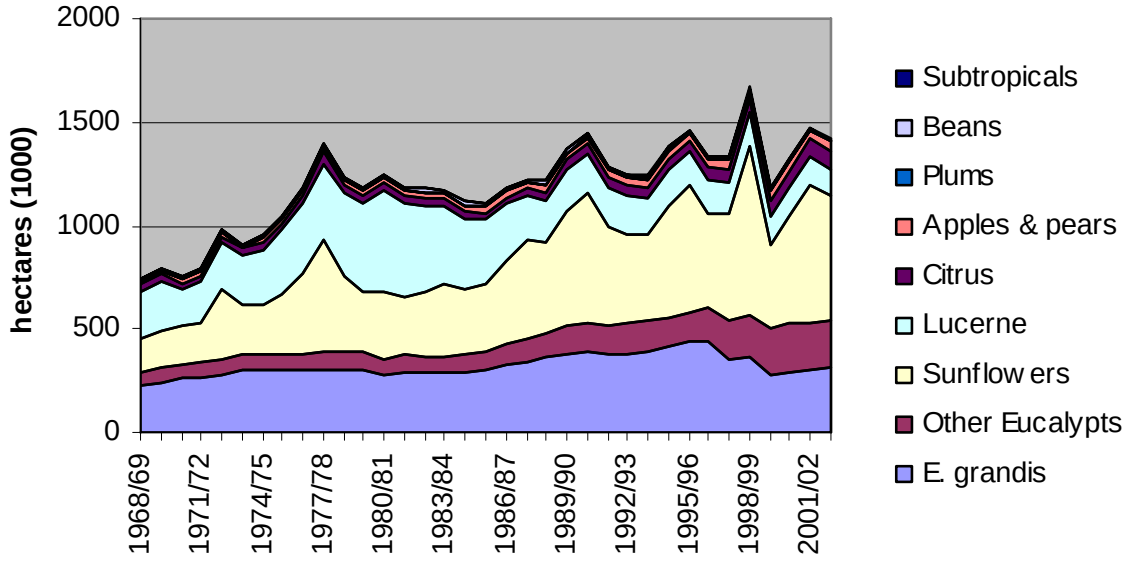

Figure 3: Total areas planted to melliferous flora in South Africa

Table 5 reports land ownership by size of operation. A mere 11% of large beekeepers own all the land on which the keep bees, compared to 30% of small beekeepers. When we include those who own some of their apiary sites, this increases the overall average ownership to 33% for small beekeepers and 17% for large beekeepers. This is statistically significant difference. A t-test of means assuming unequal variances (Hair et al, 2006) produced a t-statistic = 1.91 with a probability of rejecting the null hypothesis at p = 0.03 in the one-tailed test. This data indicates that smaller beekeepers will be better able to manage forage transitions as Eucalypt stands are being removed. Land ownership patterns remain problematic for demarcation efforts and forage planning because so little of the land used to support domestic bees is actually controlled by beekeepers that have an incentive to manage the land properly. Figure 3 confirms that forage will not expand without direction and support from the industry.

Table 5: Land ownership by size of operation

	Land on which bees are kept		
Size/ region	**Own none**	**Own some**	**Own all**
Small (≤ 100 hives)	46	5	22
Large (> 100 hives)	28	5	4
Total	74	10	26

The most common land use arrangement is to compensate landowners with a share of the honey (in 53% of cases), however 18% of respondents who keep their bees on land that does not belong to them, indicated that no formal land use arrangement exists. This is similar to Allsopp & Cherry's (2004) result that no land use arrangement exists in 16% of cases.

Table 6 reports the bee forage strategies employed by large and small beekeepers. There is no statistical difference between large and small beekeepers when it comes to feeding bees. There is also no difference in this regard between beekeepers who offer pollination services and those who do not. Exactly half the respondents indicated that they feed bees on occasion or when necessary.

Table 6: Bee forage strategies by size and pollination involvement

	% respondents who feed or move bees		
Strategy	**All beekeepers**	**Pollination**	**Honey only**
Feed bees			
Small (≤ 100 hives)	49%	57%	47%
Large (> 100 hives)	53%	52%	54%
Move bees to follow forage excluding for commercial pollination			
Small (≤ 100 hives)	34%	79%	23%
Large (> 100 hives)	66%	74%	45%
Distance travelled on one round trip			
Small (≤ 100 hives)	73 km	117 km	63 km
Large (> 100 hives)	187 km	210 km	131 km

In contrast, depending on the size of operation, there is a marked difference in whether moving bees is part of a beekeepers strategy and whether he is involved in commercial pollination. Only a third of small beekeepers in the sample indicated that they move bees in search of forage compared to two thirds of large beekeepers who indicated that they do. The difference across size is statistically significant with a t-statistic = -3.36 and a probability of rejecting of p = 0.005 in the one tailed test. This pattern is different for beekeepers involved in commercial pollination and those who are strictly honey producers. Pollinators are almost equally likely to move bees whether they have large or small operations, and they are substantially more likely to do so than people who produce honey exclusively. This is not surprising since the ability to move one's bees is a prerequisite for providing pollination services while a honey producer just needs to be able to transport honey from his various apiary sites. Large honey producers still move bees in 45% of cases compared to small honey producers of which only one in four move bees as part of their forage strategy. This difference is again statistically significant with a t-statistic equal to -1.53 and a probability of rejecting in the one tailed test of p = 0.066.

Small beekeepers are also closer to their forages than large beekeepers, and beekeepers involved in pollination are further away from their bees than those who only specialise in honey production. The difference between small and large beekeepers in terms of the average distance travelled is statistically significant at the 10% significance level in all three cases. For the whole sample the t-statistic is t = -3.39 with a probability of rejecting at p = 0.000. For the subsample of beekeepers involved in pollination the t-statistic = -1.43 with a probability of rejecting of p = 0.080. Finally for the subsample of beekeepers specialising in honey production the t-statistic = -1.96 for which the probability of rejecting the assumed equal means is p = 0.027.

Table 7 shows the average annual honey yield per hive reported in the survey for the three sites for which we have data. Pollinators generally acknowledge that they are not primarily maximising honey production, but region or size of operation might play a role in average yield.

Comparing all beekeepers across the country (last column top panel) there is no statistically significant difference between beekeepers who focus on honey production and those who focus on pollination, which suggest that the pollination penalty so often talked about is a myth! If we restrict the sample to large beekeepers only (the middle column) there is no discernible difference in reported yields either, but it looks as if the yields reported by small beekeepers might suffer a pollination penalty. A t-test of means assuming different variances indicates that means are not statistically different from each other for any of the three sites, which means that the smaller yields recorded by small

beekeepers providing pollination services are not a consistent feature of the whole population. There are two explanations for this strange result, the first of which is technical: sample size is just too small to produce a significant difference. The second reason is more real in the sense that it is due to large variances in the underlying data.

Table 7: Honey yield in kilogram per hive per year

			Size of operations		
Region	**Focus**	**Site***	**Small**	**Large**	**All**
All	Honey	A	25.1	37.6	26.9
		B	19.8	41.0	25.1
		C	18.7	39.1	25.8
	Pollination	A	12.8	23.6	20.1
		B	15.1	31.9	27.5
		C	11.3	38.5	31.2
Western Cape	Honey	A	21.5	39.7	23.6
		B	20.5	51.0	25.6
		C	22.9	50.5	27.9
	Pollination	A	7.3	14.7	13.7
		B	7.0	16.5	15.8
		C	7.5	18.1	17.3
Rest of the country	Honey	A	28.5	36.4	29.9
		B	19.1	37.0	24.7
		C	9.1	34.6	23.3
	Pollination	A	14.1	35.2	25.2
		B	16.4	60.4	40.1
		C	12.1	86.4	49.3

* subsamples

The national average honey yield of in the region of 25 kilograms of honey per hive per year in Table 7 is un-weighted across beekeepers. If properly weighted, this sample will produce an average far higher than the average of 25 kilograms per hive reported as SABIO's estimate. The yields shown here are also substantially higher than the yields recorded by Allsop & Cherry (2004) for the

Western Cape. The middle and bottom panels of Table 7 divide the sample into subsamples for the Western Cape and the rest of the country. The patterns are largely the same except that it looks as if large pollinators also suffer a pollination penalty while large pollinators in the rest of the country achieve the same yields as their counterparts who only focus on honey production.

This finding has an important implication for the choice of funding mechanisms. In the Western Cape there seems to be a trade-off between honey production and pollination, which implies that both types of income needs to be levied for maximum coverage. It will be unfair to beekeepers who are primarily honey producers to not levy their colleagues who keep bees mainly for pollination. In the rest of the country there seems to be no trade-off between honey production and pollination and consequently taxing honey and not pollination, would not affect coverage.

Damage & vandalism

Vandalism, fire, and animal damage varied dramatically across responses. Many lucky beekeepers indicate that they do nothing because they do not have a problem with theft or animals. Others are clearly exasperated at the damage done especially by criminals. Several reported the use of electrical fencing or sturdy individual wire mess cages and at least one person reported that his hives are guarded by armed guards. Table 8 records the overall picture.

Table 8: Incidence of theft and vandalism and precautions taken

Incidence/ strategy	**Small**	**Large**	**All**
Take precautions against			
- natural damage	67%	78%	71%
- vandalism / theft	60%	59%	60%
Use specific preventative measure			
Fire breaks	40%	43%	41%
Hive strapping	29%	24%	28%
Hive stands	24%	27%	25%
Enclose apiary sites	30%	30%	30%
Close to homesteads	17%	5%	13%

Large beekeepers are slightly more careful in terms of protecting their apiary sites against fire and other natural damage than small beekeepers, but the same proportion of both groups indicate that they protect their apiary sites against theft and vandalism. Theft and vandalism is not a north-south phenomenon; Western Cape beekeepers (58%) report taking slightly less precautions against theft than beekeepers elsewhere in the country (62%), however the difference is not statistically significant.

Firebreaks are the most commonly reported precaution, followed by the use of hive strapping, hive stands and fenced apiary sites. Small beekeepers often keep their hives close to their own or the landowner's homestead, but this strategy is not feasible for large beekeepers that simply have too many colonies to make this a viable strategy.

Markets & prices

The honey market is highly disaggregated and specialised. Different participation rates are reported in Table 9. All of these differences are statistically significant at better than 5%, except for the probability of selling directly to the public and bottling some of one's own honey.

Table 9: The proportion of the sample using each outlet

Outlets	Small	Large	All
Direct to the public	78%	76%	78%
Small independents[3]	41%	66%	49%
Bottlers & processors	27%	71%	42%
Supermarkets	5%	53%	21%
Exports	1%	11%	4%
Avg. outlets used	1.7	3.7	2.5
Bottle own honey	82%	89%	85%
Bottle other honey	7%	38%	10%
HACCP	1%	11%	5%

Note: 1) Respondents listed all outlets used, so totals do not add up to 100
2) Figures reflect access only without indicating share of output going into a given outlet.
3) Farm stalls, health stores, markets, butcheries, hairdressers, cooperatives, restaurants, etc.

Small beekeepers on average sell into 1.7 outlets, usually directly to the public and into one of many types of small independent outlets such as pharmacies, hairdressers, local cooperatives and restaurants. A small proportion of small beekeepers also sell to bottlers and processors. Virtually no small beekeepers supply directly to supermarkets or export directly. In contrast the average large beekeeper sells into 3.7 different outlets, including directly to the public, small independents, bottlers and processors, and supermarkets. Very few large beekeepers export directly.

Small beekeepers are as likely to bottle some of their own honey as large beekeepers, but significantly more likely to also bottle other honey on their premises (t-stat = -1.52, p = 0.065). Large beekeepers are also statistically more likely to have HACCP food safety accreditation than small beekeepers (t-stat = -2.30, p = 0.012). It clear from Table 9 that beekeepers only become HACCP accredited in order to export honey.

The survey did record the average honey price received in 2007 but failed to ask if this was for bottled or bulk honey. Most respondents sensibly told us which they meant, which allowed us to calculate an average bottled and bulk price, of R44.86 and R25.38 per kilogram respectively. Figure 1 gives the distribution of these prices. Large beekeepers who sell in bulk are really prices takers at R22 per kilogram although several smaller beekeepers reported bulk prices around R35 to R38 per kilogram. In contrast the market for bottled honey is a seller's market with prices ranging up to R60 and R70 a kilogram. The average price for bottled honey was virtually identical for small and larger beekeepers, at R44.89 and R43.33 respectively.

Price elasticity of supply is a term used by economists to describe how producers react to a price increase. Supply is said to be elastic when a given price increase causes a large response in quantity supplied, and inelastic when quantity supplied does not respond much to a similar price increase. Price elasticity can be estimated if enough price and quantity data is available and has to be estimated jointly with factors that affect demand. Policy makers are often quite interested in price elasticities of supply (and demand) since it allows them to predict the effect of for example taxing an industry or introducing a minimum wage or removing a trade tariff.

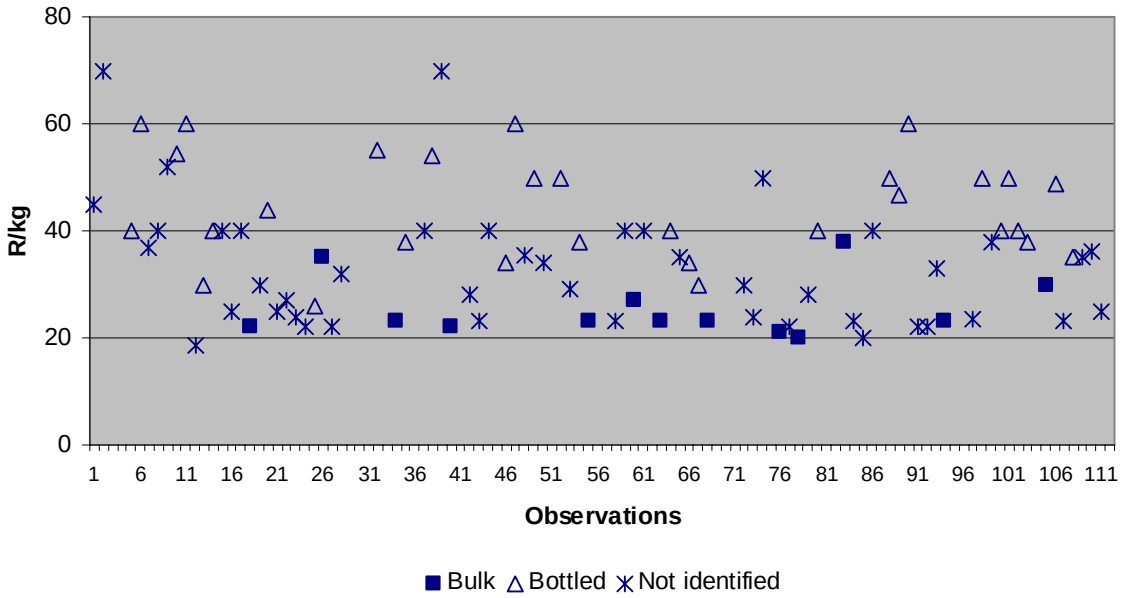

Figure 1: Reported nominal honey prices for 2007

Since this dataset has only one year's worth of price data and no way of modelling the demand faced by an individual producer, a price elasticity of supply cannot be estimated directly. However, the questionnaire contained two questions that shed some light on potential supply responses, namely the honey price at which the beekeeper would consider increasing the number of colonies and the price at which the number of colonies would be reduced. Almost 20% of respondents did not report a honey price, several indicating that they only produce for home consumption, and therefore did not have a honey price to report. Many others gave various reasons why the questions on the price sensitivity were not sensible or valid. At least one respondent carefully explained that 'happy bees were more important than money' and several others implied something similar. The 82% response on the question of actual price drops to 35% on the 'expand operation' question and to 18% percent on the 'contract operation' question. Only 45% of respondents indicated that they know the cost of honey production. Together this indicates that honey producers are not likely to respond much to economic factors such as taxation or falling market prices.

Affiliation

The survey collected data on SABIO and regional membership and on the proportion of beekeepers that pay various voluntary membership fees. At 93% compliance, SABIO membership within the sample is high, but not surprising in the light of the sampling frame that was used. It is unclear why so many respondents (55%) are also affiliated with regional beekeepers' organisations. Presumably certain needs are best met locally, for example being able to call up a fellow beekeeper to enquire about pest control or forage conditions, while the national association performs other useful services such as fighting Eucalypt legislation. Further research should investigate which functions should best be performed locally and which nationally.

There is a statistically significant difference (t-stat = -1.71, p = 0.045) between large and small beekeepers in terms of compliance with a voluntary levy. Less than 60% of small beekeepers comply compared to 76% of large beekeepers pay the voluntary levy. Curiously there is a huge difference between smaller small beekeepers (<30 hives) and larger small beekeepers (30 – 100 hives). Only a third of the former comply compared to 97% of the latter. The difference is statically highly with a t-statistic = -6.78 with probability of rejecting of p = 0.000. Participating in bee insurance obtained via SABIO is as expected. Thirty percent of small beekeepers indicated participation, compared to 57% of large beekeepers. The difference is statistically significant (t-stat = -2.77, p = 0.003).

Profile of beekeepers

Table 10 summarises selected personal characteristics of beekeepers by size of operations. Curiously the language split, which incidentally is statistically significant (t-stat = 2.17, p = 0.016), is exactly opposite for large and small beekeepers. This variable is one of the most sensitive to sample size and the most likely to change substantially as the sample is expanded. More importantly, it indicates that there is a need to translate industry materials and information into Afrikaans.

Small beekeepers are generally slightly better educated than commercial beekeepers, but while the difference is statistically significant (t-stat = 2.08, p = 0.020) the difference is too small to be meaningful. There is no statistical difference between large and small beekeepers in the proportion of the sample who attended a bee training course.

Table 10: Profile of beekeepers in the sample

Characteristic	Small	Large	All
Afrikaans speaking	39%	61%	46%
English speaking	61%	39%	54%
Total	100%	100%	100%
Formal education	14.5	13.6	14.2
Bee course	53%	55%	54%
Experience			
< 2 years	15%	5%	12%
2 – 10 years	44%	5%	31%
> 10 years	41%	90%	57%
Total	100%	100%	100%

There is a significant difference (t-stat = -4.58, p = 0.000) in beekeeping experience for large and small beekeepers. The subsample of small beekeepers has a larger proportion of entrants (15%) than the subsample of large beekeepers (5%). Almost all large commercial beekeepers have more than ten years experience of beekeeping, compared to 41% of small beekeepers. Clearly one does not build a successful bee business overnight. Most commercial beekeepers probably started off as hobbyists and went commercial 'by accident' as much as by intention.

Outlook for industry organisation

The purpose of this survey was to shed some light on the size and composition of the beekeeping industry in South Africa so that it might inform efforts to effectively organise it. Unfortunately the size of the industry cannot really be inferred from the data collected. We got, as expected, a response rate in the low twenties, which indicates that we used a proper sampling frame. This together with the fact that the sample's geographical distribution virtually co-incides with the sampling frame's distribution validates the data.

Allsopp & Cherry's (2004) data on the number of beekeepers in the Western Cape has important implications for estimates of industry size. First, SABIO's

estimate of the number of 1800 beekeepers in the country could be as low as 900. Second, if the Western Cape has 34 000 domesticated honey bee colonies, it is not inconceivable that the industry consists of 120 000 hives, but at 94 colonies per beekeeper the industry could also be as small as 90 000 hives. Our estimate of the average number of hives per beekeeper is 174, which for 1800 beekeepers implies a domestic honey bee population of more than 300 000 colonies and for 900 beekeepers at least 150 000 hives.

Perhaps the most controversial finding in Allsopp & Cherry (2004) is their reported yield of less than 15 kilograms of honey per hive per year. Thirty years ago Fletcher & Johannsmeier (1978) complained that beekeepers do not keep proper honey records, and it is unclear from responses in this survey that things have improved substantially since then. However, our data does indicate that Western Cape beekeepers who do pollination, on average reported yields around 15 kilograms per hive, compared to 25 kilograms per hive for their colleagues who specialise in honey production. To use simple round numbers, a hundred thousand hives at 15 kilograms each implies a honey crop of 1500 tons compared to 2500 tons if the average yield is 25 kilograms per hive. On the other hand, reported honey yield outside the Western Cape is substantially higher and not reduced as much by pollination as in the Western Cape, especially for large beekeepers. This suggests that the honey crop might be closer to 2500 tons than to 1500 tons per year. The finding that the honey market is so disaggregated unfortunately does not help with a more accurate estimate of the size of the industry. We do however know anecdotally that supermarkets absorb between 1200 and 1500 tons of honey per year, and it is not inconceivable that as much finds alternative outlets.

We have implicitly used a hundred hives as an upper limit for hobbyists, because it fits the distribution of the data well. However, it must just be reiterated that willingness to contribute to the industry is markedly different for the smaller and the larger halves of the hobbyist category. The data indicates that it is not necessary to exempt all hobbyists from membership fees and other industry levies. Furthermore, hobbyists generally have a different forage pattern than large commercial beekeepers, especially in terms of land use. Since they are more likely to keep bees on their own land, and often in secret places than commercial beekeepers, they will be far more difficult to convince of the need for registration and demarcation. It might be worthwhile to consider initially exempting small apiaries on beekeepers' own land from registration.

Aknowledgements

We would like to thank the SABIO office for assistance with administering the survey and members of the 2008 BEECON organising committee for commenting on earlier drafts. Any remaining errors are our own. Finally, our sincere thanks to all beekeepers who responded generously contributing of their time and data.

References

Allsopp M & M Cherry (2004). An assessment of the impact on the bee and agricultural industries in the Western Cape of the clearing of certain Eucalyptus species using questionnaire survey data. *www.sabio.co.za*

Fletcher DJC and MF Johannsmeier (1978). The status of beekeeping in South Africa. *South African Bee Journal* 50(4): 5 – 20

Forestry South Africa (2006). Forestry and FP industry facts 2005. *www.forestry. co.za*

Hair, JF jr., WC Balck BJ Balsin, RE Anderson and RL Tatham (2006). *Multivariate data analysis 6th edition*. Pearson Prentice Hall.

National Agricultural Marketing Council (NAMC) (2008). *The South African beekeeping industry: A section 7 committee investigation.* 3rd draft. Pretoria

National Department of Agriculture (2007). Abstract of Agricultural Statistics. www.nda.gov.za