Canadian Association of Professional Apiculturists
Statement on Honey Bee Wintering Losses in Canada (2019)

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Summary

The Canadian Association of Professional Apiculturists (CAPA) coordinated the annual honey bee wintering loss report for 2018-2019. As in previous years, the survey consisted of harmonized questions based on the national beekeeping industry and the Provincial Apiculturists collected the survey data. All provinces were included in the national survey. The respondents operated 398,728 honey bee colonies across Canada. This represents 50% of all colonies operated and wintered in the country in 2018-2019. The national winter loss, including non-viable bee colonies was 25.7% with provincial losses ranging from 19.8% to 54.1%. The overall national colony loss reported in 2019 is in the middle range of reported losses since 2007. Through the hard work of beekeepers replacing loses and making increases, Statistics Canada reports show that the total colony count has increased by 35.2% during the period between 2007 and 2018.

Respondents reported some variation in identifying and ranking the top four possible causes of colony losses across the country. The most frequently cited causes in order from high to low were: weather, starvation, poor queens, and weak colonies in the fall.

Beekeepers also responded to questions on the management of three serious parasites and pathogens to beekeeping: Varroa mites, *Nosema spp*. and *Peanibacillus larvae* (the causal bacteria of American foulbrood disease). The majority of beekeepers in most provinces reported that they monitored for Varroa mites. The most commonly reported Varroa treatments were Apivar® and formic acid (Mite Away Quick Strip® (MAQS), repeated 40 ml of 65% formic acid treatments or flash treatments) in spring, Apivar® or formic acid (MAQS or flash treatments) in the summer or fall and oxalic acid in late fall. Many beekeepers reported using spring and fall applications of Apivar® or Apivar® plus formic or oxalic acid to keep mites under control in 2018. Nosemosis and American foulbrood were treated by many Canadian beekeepers. Across the country registered antibiotics were the commonly used treatments; but methods and timing of application varied from province to province.

Provincial Apiculturists, Tech-transfer agents and researchers have been working with beekeepers across Canada to encourage them to monitor honey bee pests, especially Varroa mites and nosema, and adopt recommended integrated pest management practices to keep these pests under control. Through various working groups, that include various stakeholders, CAPA members continue to work on development and improving management options for beekeepers to keep healthy bees. CAPA members are also actively involved in the Federal Bee Health Roundtable to develop strategies that work toward addressing risks and opportunities for developing a sustainable, healthy beekeeping industry.

Disclaimer: Survey data were supplied by the provincial apiarist of each province. The data were then compiled and further analyzed by the CAPA National Survey Committee.

Introduction

For over a decade, many countries, including Canada, have surveyed beekeepers and reported overwintering mortality of honey bee colonies and management practices used for Varroa mites, nosema and American foulbrood. The Canadian Association of Professional Apiculturists (CAPA) has worked with the Provincial Apiculturists to report on wintering losses of honey bee colonies and possible causes of bee mortality in Canada since 2007. The objective of this national report is to consolidate provincial honey bee losses across the country based on data collected through harmonized survey questions. The possible causes of winter loss, as reported by beekeepers and information on pest surveillance and control are surveyed and included in this report. The survey results aid in identifying gaps in current management systems, developing strategies to mitigate colony losses and improving bee health, biosecurity practices, and industry sustainability.

Methodology

In 2019, the Provincial Apiculturists and the CAPA National Survey Committee members reviewed the questions used in the 2018 survey and made necessary revisions. Examples of these revisions include new treatments or new strategies for beekeepers to manage pests and diseases as they are developed over the years. The result was an updated harmonized set of questions that was used in the 2019 survey (Appendix A). These questions took into account the large diversity of beekeeping industry profiles, management practices and seasonal activities within each province. Some provinces also included supplementary regional questions in their provincial questionnaire. Results of these regional questions are not included in this report but it can be accessed by contacting the Provincial Apiculturist of the province in question (Appendix B).

Commercial beekeepers and sideliners that owned and operated a specified minimum number of colonies (Table 1) were included in the survey. The survey reported data from full-sized producing honey bee colonies that were wintered in Canada, but not nucleus colonies. Thus, the information gathered provides a valid assessment of honey bee losses and management practices.

The common definitions of a honey bee colony and a commercially viable honey bee colony in spring were standardized as follows:

- Honey Bee Colony: A full-sized honey bee colony either in a single or double brood chamber, not including nucleus colonies (splits).
- Viable Honey Bee Colony in Spring: A honey bee colony that survived winter, with a minimum of 4 frames with 75% of the comb area covered with bees on both sides on May 1st (British Columbia), May 15th (New Brunswick, Nova Scotia, Ontario, Prince-Edward-Island and Quebec) or May 21st (Alberta, Manitoba, and Saskatchewan).

The colony loss and management questionnaire was provided to producers using various methods of delivery including mail, email, an online and a telephone survey; the method of delivery varied by jurisdiction (Table 1). In each province, data were collected and analyzed by the Provincial Apiculturist. All reported provincial results were then analyzed and summarized at the national level. The national percent of winter loss was calculated as follows:

$$\text{Percentage Winter Loss} = \left(\frac{\text{Sum of the estimated total colony losses per province in spring 2019}}{\text{Sum of total colonies in operation in each province for 2018}}\right) \text{x } 100$$

Results

Throughout Canada, a total of 536 sideline and commercial beekeepers responded to the 2019 survey. These respondents represented 44% of the all surveyed targeted beekeepers. They operated nearly 50% of all registered colonies that were put into winter in 2018. Although the number of reported colonies is down from 46.6% of beekeepers responding representing 63.9% of bees in Canada in the 2018 survey, the participation rate and representation of the industry can still be considered to be good.

The survey delivery methods, operation size of surveyed beekeepers, and response rate of beekeepers in each province are presented in Table 1. It is important to note that the total number of colonies operated in a province reported in this survey may vary from the Statistics Canada official numbers. In some provinces the data collection periods for the provincial database and the Statistics Canada numbers are at different times of the year. This can result in minor discrepancies between the official Statistics Canada total number of colonies and this surveys total reported colonies per province.

Survey results showed that the national level of wintering loss including nonviable colonies was 25.7% with individual provincial percentage ranging from 19.8% to 54.1%. The overall winter loss percentage for 2018-2019 was lower than 2017-2018 which had a loss rate of 32.6%. The level of winter loss varied from province to province, and among beekeeping operations within each province. In general, most provinces reported lower mortality in 2018-2019 than the previous year, the exception being Nova Scotia reporting similar mortality to last year and Prince Edward Island and Newfoundland/Labrador reporting higher mortality than last year. Prince Edward Island reported the highest winter losses of 54.1% in 2019 with weather cited as being the most frequent cause contributing to colony mortality. The lowest winter loss (19.8%) was reported by Nova Scotia again this year.

Overall 72% of the colonies owned by respondents were wintered outdoors in fall 2018. The rest of the colonies (28%) were wintered indoors (Table 2). The highest percentage of bee colonies wintered indoors was in Nova Scotia (75%), followed by Quebec (66%) and New-Brunswick (60%). The mortality rate for colonies wintered outdoors and indoors for each province is presented in Table 3. The mortality rate is calculated only for provinces where enough colonies are wintered indoors to have a fair representation of this wintering technique.

For detailed information about the winter losses in each province, please contact each province directly for a copy of its provincial report where available.

Table 1: Survey parameters and honey bee colony mortality by province

Province	Total number of colonies operated in 2018	Estimated number of colony lost based on the estimated provincial winter loss	Type of data collection	Number of beekeepers targeted by survey	Number of respondents (% of participation)	Size of beekeeping operations targeted by survey	Number of respondents' colonies that were wintered in fall 2018	Number of respondents' colonies that were alive and viable in spring 2019	Percentage of surveyed colonies to the total number of colonies in the province	Provincial Winter Loss including Non-viable Colonies
Newfoundland and Labrador	425	127	Email, Telephone, Text message	9	9 (100%)	20 col. and more	426	299	100%	**29.8%**
Prince Edward Island	6 000	3 246	Email, Telephone	50	17 (34%)	All sizes	5 330	2 448	89%	**54.1%**
Nova Scotia	25 210	4 992	Email	41	20 (49%)	50 col. and more	16 058	12 877	64%	**19.8%**
New Brunswick	11 998	3 155	Email, Telephone, Postal	30	16 (53%)	50 col. and more	8 628	6 360	72%	**26.3%**
Quebec	65 128	16 282	Email, Telephone, Postal	137	108 (79%)	50 col. and more	50 198	37 669	77%	**25.0%**
Ontario	100 413	22 693	Email, Telephone, Postal, Online	218	87 (40%)	50 col. and more	48 418	37 469	48%	**22.6%**
Manitoba	114 098	24 417	Email	112	34 (30%)	100 col. and more	46 091	36 249	40%	**21.4%**
Saskatchewan	114 000	24 396	Online	120	47 (39%)	100 col. and more	47 087	36 999	41%	**21.4%**
Alberta	311 374	89 676	Online	111	43 (39%)	400 col. and more	121 786	86 680	39%	**28.8%**
British Columbia	54 706	17 451	Online	403	155 (39%)	10 col. and more	54 706	37 242	100%	**31.9%**
Canada	**803 352**	**206 435**		**1231**	**536 (44%)**		**398 728**	**294 292**	**50%**	**25.7%**

Table 2: Overwintering method by province

Province	Bee colonies owned by responding beekeepers wintered outdoors in fall 2018		Bee colonies owned by responding beekeepers wintered indoors in fall 2018	
	Number of colonies	**Percent (%)**	**Number of colonies**	**Percent (%)**
NFL	423	99	3	1
PEI	5 328	100	2	0
NS	3 958	25	12 100	75
NB	3 468	40	5 160	60
QC	16 916	34	32 982	66
ON	38 485	79	9 933	21
MB	28 139	61	17 952	39
SK	30 209	64	16 878	36
AB	105 771	87	16 015	13
BC	54 387	99	410	1
Canada	**287 084**	72	111 435	28

Table 3: Indoor and outdoor wintering mortality as reported by responding beekeepers

Province	Total number of colonies wintered **outdoors** in fall 2018	Total number of viable colonies wintered **outdoors** in spring 2019	Percent of losses of colonies wintered **outdoors (%)**	Total number of colonies wintered **indoors** in fall 2018	Total number of viable colonies wintered **indoors** in spring 2019	Percent losses of colonies wintered **indoors (%)**
NFL	423	295	30.3	3	3	N/A
PEI	5 328	2 447	54.1	2	1	N/A
NS	3 958	3 310	16.4	12 100	9 567	20.9
NB	3 468	2 590	25.3	5 160	3 770	26.9
QC	16 916	11 670	31,0	32 982	25 762	21.9
ON	38 485	29 598	23.1	9 933	7 871	20.8
MB	28 139	22 115	21.4	17 952	14 134	21.3
SK	30 209	24 200	19.9	16 878	12 799	24.2
AB	105 771	76 969	27.2	16 015	9 711	39.4
BC	54 387	36 928	32.1	410	314	N/A
Canada	287 084	210 122	26.8	111 435	83 932	24.7

Contributing factors as cited by beekeepers

Beekeepers were asked to rank possible contributing factors to colony losses. These responses are summarized in Table 4. Weather was considered an important factor for winter loss across the country, likely reflecting the very long and cold winter in addition to the cold periods of weather well into April and May through many beekeeping areas. In six provinces, weather was considered the number one (five provinces) or number two (one province) factor contributing to reported winter losses. Similar to the previous year, beekeepers reported that a lot of bee colonies died in April and into early May.

Starvation was the second most reported cause of winterkill by beekeepers in several regions across Canada. Starvation can be the result from the inability of bees in weak colonies to store enough stored food during the fall, the inability of bees to move to new resources within the hive during winter, the rapid consumption of stored food because of early brood production, or insufficient feed provided by the beekeeper in the fall or spring. During the winter of 2018-2019, starvation may be associated with increased consumption of stored food during the long cold winter and extended cold through the spring.

Poor or failing queens were also another commonly cited as a cause of winter loss across Canada. Poor queens can result in weakened colonies entering the winter; this causes an insufficient number of bees in the colony to survive. If a queen fails or dies over the winter, the colony will die as well because there is no opportunity for the beekeeper to replace the queen and the bees cannot rear a new queen during the winter season. The poor and failing queens can be caused by many factors, including, inadequate rearing conditions, poor mating weather, age of the queen or exposure to pesticides in hive and in the environment. The recent increase of queens as a reported cause for winter mortality is a concern that should be investigated further.

Another contributing factor identified across Canada was weak colonies in the fall. This can be caused by a variety reasons including: making late splits (nuclei), underlying pest and disease issues, exposure to pesticides, or poor foraging and nutrition.

Ineffective Varroa control was reported as the third or fourth possible contributing factor to winter colony loss in only three provinces. While the Varroa mites and their impacts on the honey bee health are still a serious issue for Canadian beekeepers, reported survey results may indicate that most beekeepers are treating in a timely manner to keep mite populations under control. Many beekeepers across the country are relying on multiple Varroa treatments in a year as it better enables beekeepers to protect their bees in the winter. Unfortunately, some individual producers treated Varroa too late, which results in wintering bees being less healthy from the impacts of Varroa and associated viruses. These beekeepers often report winter mortality greater than 30% and frequently reported mites as a primary concern.

Several beekeepers in different provinces reported that they did not know why their colonies perished. Inability to identify a possible cause for colony mortality may be associated with lack of applying best management practices including monitoring for pests, diseases and other general colony health parameters during the season, or a multitude of underlying problems that cannot be identified without specialists.

Operations that reported higher than 25% winter loss were asked to rank the top four possible causes of bee colony mortality in the 2018-2019 survey. These data are summarized in Table 5. Weather, starvation and poor queens are still the 3 most cited causes of winter loss for these operations. Overall, there were no striking differences between reported causes of winter losses across the provinces and operations that reported 25% or more winter losses.

Table 4: Top four ranked possible causes of honey bee colony mortality by province, as cited by beekeepers who responded to the 2018-2019 winter loss survey

Province	**1st.**	**2nd.**	**3rd.**	**4th.**
NL	Other (rodents)	Weak colonies in the fall	Weather	Starvation
PEI	Weather	Starvation	Ineffective Varroa control	Poor queens and Other (shrew predation)
NS	Weak colonies in the fall	Weather	Poor queens	Starvation
NB	Weather	Don't know	Poor queens	Starvation
QC	Weather	Starvation and Poor queens	Weak colonies in the fall	Ineffective Varroa control
ON	Starvation	Poor queens	Weather	Weak colonies in the fall
MB	Poor queens	Starvation	Weather	Weak colonies in the fall
SK	Starvation	Poor queens	Weather	Weak colonies in the fall
AB	Weather	Poor queens and Starvation	Ineffective Varroa control	N/A
BC	Weather	Weak colonies in the fall	Starvation	Poor queens

Table 5: Top four ranked possible causes of bee colony mortality by province, as cited by beekeepers who reported higher than 25% losses in the 2018-2019 winter loss survey

Province	1st.	2nd.	3rd.	4th.
NL	Other (rodents)	Other (trial experiment)	Weather	N/A
PEI	Weather	Starvation	Ineffective Varroa control	Other (shrew predation)
NS	Other (pygmy shrews) and Starvation	Weak colonies in the fall	Weather	Poor queens
NB	Poor queens	Don't know	Weather	Ineffective Varroa control
QC	Weather	Starvation	Ineffective Varroa control	Poor queens
ON	Weather	Starvation and Poor queens	Ineffective Varroa control and Nosema and Weak colonies in the fall	N/A
MB	Starvation	Weather	Poor queens	Don't know
SK	Starvation	Poor queens	Weather	Weak colonies in the fall
AB	Weather	Poor queens	Starvation and Ineffective Varroa control and Weak colonies in the fall	N/A
BC	Weather	Weak colonies in the fall	Starvation	Poor queens

<u>Bee Pest Management Practices</u>

In recent years, Integrated Pest Management (IPM) has become the most important practice to maintain healthy honey bees. To successfully manage bee health, beekeepers must identify and monitor pests and diseases to take timely action in accordance with approved methods. This survey focused on asking beekeepers questions about their management of three serious threats that may impact bee health, survivorship and productivity (Appendix A).

A. Varroa monitoring and control[1]

The Varroa mite continues to be considered by beekeepers and apiculture specialists as one of the main causes of honey bee colony mortality.

During the 2018 production season, a large majority of surveyed beekeepers monitored for Varroa mite infestations (Table 6). The alcohol wash of a sample of 300 bees per colony was the most preferred technique in all provinces, except Quebec where beekeepers favoured the use of sticky boards and British Columbia where beekeepers preferred the technique using icing sugar. The frequency of use for the alcohol wash technique in various provinces ranged from 22% to 81%. The frequency of use of the sticky board method ranged from 0% to 37%. Some beekeepers used both sticky boards and alcohol wash methods to evaluate the levels of mites. These results demonstrate that most Canadian beekeepers recognize the value of monitoring Varroa mites. The education and extension programs delivered to beekeepers in Canada have helped in adoption of recommended management practices for Varroa mites. The goal is to have all beekeepers actively monitoring Varroa mite populations to improve timing and selection of the best treatment options for Varroa mite control.

In Canada there are a variety of registered miticides available to beekeepers for mite control. Beekeepers are encouraged to use the most effective miticide that fits their region, season and operation. Beekeepers are encouraged to rotate miticides to prevent the development of resistance to these products. In the current survey of bee winter losses, beekeepers were asked "what chemical treatment was used for Varroa control during the 2018 season". The beekeepers' response is summarized in Table 6. In the spring of 2018, the percentage of beekeepers that treated with chemical methods ranged from 38% in New Brunswick to 100% in Saskatchewan. The main miticide used for spring Varroa control was Apivar® (a synthetic miticide with the active ingredient amitraz). The second most common treatment is formic acid in late spring, followed by oxalic acid. In fall of 2018, most Canadian beekeepers ranging from 67% in Alberta to 98% in Quebec treated their colonies for Varroa. The main miticides used at this time of the year were oxalic acid, Apivar® and formic acid. It was noted that some beekeepers used Apivar® twice in the same year in 2018, once in spring and again in fall. More and more beekeepers have started to combine Apivar® with formic or oxalic acid in the fall for keeping control of the mite population.

Few beekeepers used Apistan® (a synthetic miticide with the active ingredient fluvalinate) and Checkmite+® (a synthetic miticide with the active ingredient coumaphos). Beekeepers may be leery of these products because of previously reported resistance to these active ingredients in Canada.

Once again, these surveys show that Apivar® (amitraz) is one of the most commonly used miticides for treating Varroa in Canada. Through the repeated use of Apivar®, it is only a matter

[1] No varroa mites are found in Newfoundland so data were only analyzed for provinces with this pest.

of time before we see the development of resistance to this miticide. Initial findings of decreased efficacy have been observed in some provinces. It is becoming increasingly important that beekeepers become aware of the principles behind resistance development and the importance of monitoring the efficacy of all treatments, in particular Apivar®. This will help to mitigate unforeseen failures of treatments. Beekeepers are encouraged to incorporate resistance management practices such as using appropriate thresholds for treatment, and alternating miticides with different modes of action in their Varroa treatment programs. Good biosecurity and food safety practices will also go a long way to ensure healthy bees and a safe, quality product while reducing the disease pressure.

Table 6: Varroa monitoring and chemical control methods as cited by the respondents of the 2018-2019 winter loss survey. Chemical treatment is in order from most to least commonly used.

Province	Beekeepers screening for varroa mites		Varroa control: treatment and methods			
			Spring 2018		Summer/Fall 2018	
	Sticky boards (%)	Alcohol wash (%)	% of beekeepers	Methods of treatment	% of beekeepers	Methods of treatment
NL	0	22	N/A	N/A	N/A	N/A
PEI	6	29	47	Mite Away Quick Strips®, 65% Formic acid – 40 mL multiple application, Apivar®	88	Oxalic acid, Mite Away Quick Strips®, 65% Formic acid - 40 mL multiple application
NS	30	40	70	Apivar®, Oxalic acid, Apistan®	90	Apivar®, Mite Away Quick Strips®, Oxalic acid
NB	19	50	38	Apivar®	88	Oxalic acid, Apivar®
QC	37	24	53	65% Formic acid - 40 mL multiple application, Apivar®, Apistan® and Oxalic acid and 65% Formic acid - 250 ml single application	98	65% Formic acid - 40 mL multiple application, Oxalic acid, Thymovar®
ON	20	59	75	Apivar®, 65% Formic acid – 40 ml multiple application, Mite Away Quick Strips®	95	Apivar®, Oxalic acid, Mite Away Quick Strips®
MB	9	71	82	Apivar®, Oxalic acid, Bayvarol®	94	Oxalic acid, Apivar®, Mite Away Quick Strips®
SK	12	81	100	Apivar®, Oxalic acid, Apistan®	87	Oxalic acid, Apivar®
AB	21	74	65	Apivar®, Oxalic acid, 65% Formic acid – 40 ml multiple application	67	Apivar®, Oxalic acid, 65% Formic acid – 40 ml multiple application
BC	N/A	28	61	Formic acid, Apivar®, Oxalic acid	85	Formic acid, Oxalic acid, Apivar®

B. Nosemosis management practices

Nosema is a fungal pathogen that infects honey bees. *Nosema ceranae* gradually replaced *Nosema apis* to become the most frequently found nosema species in Canada. The real role of *N. ceranae* in honey bee colony survival during winter and spring build-up is still unclear. It could, in certain regions or under some circumstances have an impact and play a role in spring build up (Guzman *et al*., 2010). It was not cited by all surveyed beekeepers as a possible cause of colony mortality during the 2018-2019 winter loss survey, except in Ontario within operations with more than 25% losses.

In the survey, beekeepers reported the use of fumagillin for the treatment of nosemosis in spring and/or in fall of 2018 (Table 7). The percent of beekeepers that reported using this drug varied widely from province to province. This year, beekeepers were also asked to report all alternative treatments that they use during the spring or the fall for helping in the control of nosemosis. It's important to know that Fumagilin–B is the only product registered by Health Canada for nosema treatment. Any other products mentioned by beekeepers are not currently registered for the treatment of this disease. These products are marketed and used as a general promotor of honey bee health.

Table 7: Antibiotic (fumagillin) and alternative treatments for nosemosis as cited by the respondents of the 2018-2019 winter loss survey

Province	**Use of antibiotic and alternative treatments for nosemosis (% of respondents)**					
	Spring treatment			**Fall treatment**		
	Fumagillin	**Other product**	**main alternative products**	**Fumagillin**	**Other product**	**main alternative products**
NL	0	0	N/A	0	0	N/A
PEI	12	0	N/A	12	0	N/A
NS	20	0	N/A	30	0	N/A
NB	19	0	N/A	25	0	N/A
QC	2	8	CompleteBee®, Apple cider vinegar	4	15	Apple cider vinegar, CompleteBee®
ON	9	0	N/A	9	2	Hive Alive®, Thymol in syrup in fall when feeding
MB	9	3	Honey B Healthy®	3	9	Honey B Healthy®, Nozevit®, Thymol
SK	30	19	Thymol based feed supplement	30	30	Thymol based feed supplement
AB	42	0	N/A	41	7	Honey B Healthy®, Bee vital®
BC	16	N/A	N/A	13	N/A	N/A

C. American foulbrood management practices

American foulbrood (AFB) is a bacterial disease of brood caused by *Paenibacillus larvae*. AFB is considered endemic in Canada, and it has been of great concern to beekeepers. Oxytetracycline and more recently tylosin and lincomycin are antibiotics registered for treating AFB in Canada. The pattern of use for these antibiotics, as reported by beekeepers is presented in Table 8. Oxytetracycline was more frequently used by beekeepers in spring and fall than the others.

Table 8: Antibiotic treatments for American foulbrood (oxytetracycline, tylosin and lincomycin) as cited by the respondents of the 2018-2019 winter loss survey

Province	Use of American Foulbrood treatments (% of respondents)					
	Spring treatment			Summer/Fall treatment		
	Oxytetracycline	Tylosin	Lyncomycin	Oxytetracycline	Tylosin	Lyncomycin
NL	0	0	0	0	0	0
PEI	6	0	0	12	0	0
NS	65	0	0	50	0	0
NB	63	0	0	25	0	0
QC	8	0	0	2	0	0
ON	70	1	1	66	0	1
MB	62	0	0	44	6	0
SK	60	0	0	62	5	0
AB	23	0	0	28	0	0
BC	11	<1	0	6	4	0

Honey Bee Winter Loss and Population in Canada Since 2007

Reported winter loss has been variable from year to year in Canada since 2007. This year, the reported Canadian winter mortality averaged 25.7%. This is better than last year but it's still higher than the long term suggested baseline/ threshold for winter losses of 15%. In fact, since the beginning of this survey in 2007, this suggested acceptable threshold has never been reached. The national winter losses were highest in 2008, 2009 and 2018 which ranged from 32.6% to 35.0%. From 2010 to 2019, the national winter losses ranged from 15.3% to 32.6%, averaging 23.6%. During the period between 2007 and 2018 Statistics Canada reports showed that the total colony count increased by 35.2%.

Each lost colony costs beekeepers time and money to replace. Individual beekeepers experiencing high winter mortalities face large expenses replacing those lost bees. These increased expenses greatly affect profitability for individual beekeepers and can put some beekeeping operations at risk; however, on the Canadian industry scale, the overall increase in bee colonies over the years demonstrates that despite difficulties keeping healthy, viable bee colonies through winter the Canadian beekeeping industry is resilient and able to grow.

Since the inception of this harmonized survey in 2007, beekeepers have faced challenges keeping healthy bees. Causes for bee health concerns include pest management, climatic condition, bee nutrition, and bee exposure to pesticides in hives and the environment. Another added challenge facing beekeepers is the economics of beekeeping this includes variable honey prices versus the cost of production. Even though responses from this annual survey have provided evidence that beekeepers from various regions are using recommended practices for monitoring and managing honey bee pests and diseases; there are always the opportunities to make further improvements.

It appears that stresses caused by parasites and a combination of other stressors warrants further studies to provide alternative management practices to maintain honey bee health. At this time, beekeepers have few products to control Varroa. New options are important to mitigate the risk of developing resistances. Additionally, the only product registered to treatment of nosema (fumagillin) is currently unavailable. If there is resistance developed to the primary treatment for Varroa (Apivar®) and no available treatment for *Nosema spp.*, beekeepers could suffer even greater difficulties keeping their bees alive. Ultimately, beekeepers will need more effective and additional options (miticides, antibiotics and non-chemicals) in their "tool box" if they are to continue effective integrated pest management to maintain healthy bees.

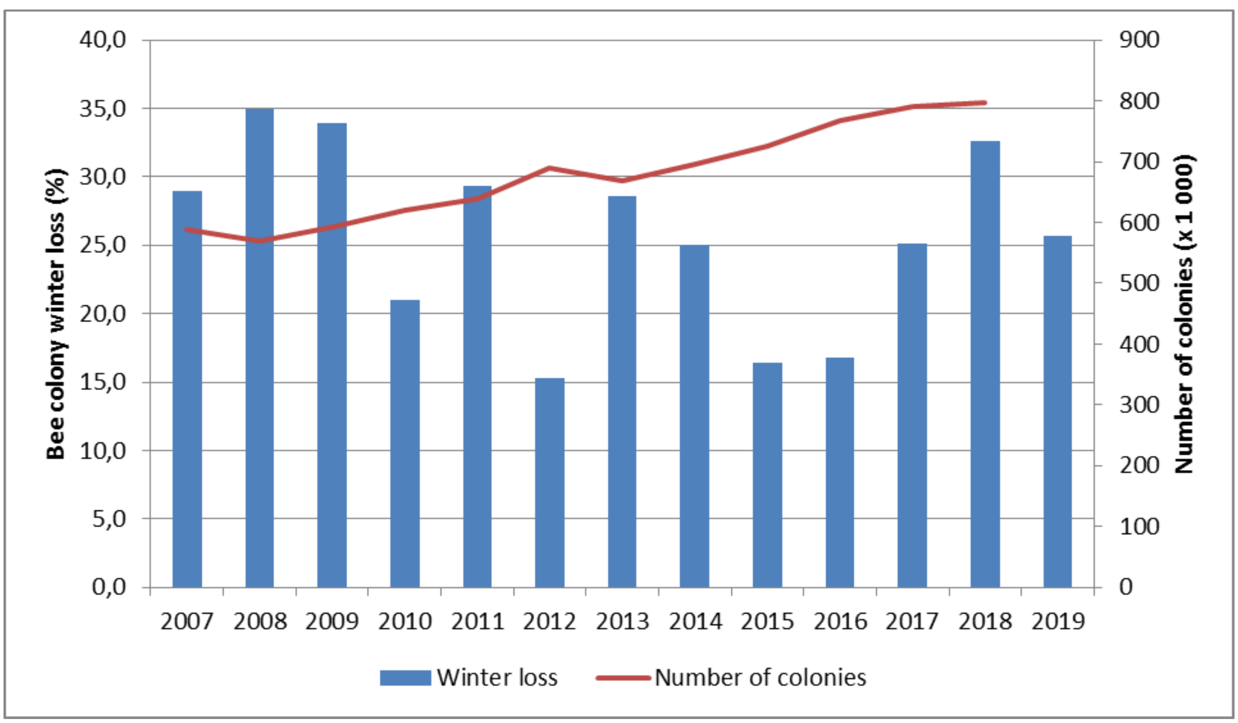

Figure 1. Summary of bee colony numbers and bee losses in Canada from 2007-2019

Further Work

CAPA members continue to work closely with industry stakeholders, the Bee Health Roundtable and provincial working groups to address bee health and industry economics. Members of CAPA and Provincial Apiculturists have also been actively involved in conducting surveillance programs at the provincial levels and across the country to monitor the status of bee health including emerging pest, and the small hive beetle. CAPA and the Provincial Apiculturists are also involved in conducting outreach and extension programs to promote IPM and biosecurity practices to beekeepers. Researchers within CAPA are active in evaluating alternative control options for Varroa mites and nosema and developing genetic stocks more tolerant to pests which will hopefully enhance the integrated pest management (IPM) practices and address honey bee health sustainability.

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Appendix A: CAPA - 2019 Core Winter loss survey questions

The followings are the core questions that will be used in 2019 by each provincial apiarist for reporting the colony winter losses at the national level. As it has been since 2007, the objective is to estimate the winter kills with a simple and standardized method while taking into account the large diversity of situations around the country. This is a survey so these questions are to be answered by the beekeepers.

1. How many full sized colonies[2] were put into winter in fall 2018?

Outdoor wintering	Indoor wintering	Total

2. How many full sized colonies[1] survived the 2018/2019 winter and were considered viable[3] on May 1st (British Columbia), May 15th (Ontario, Quebec and Maritimes) or May 21st (Alberta, Manitoba, Newfoundland and Saskatchewan)?

Outdoor wintering	Indoor wintering	Total

3. Which method of treatment did you use for varroa control in **spring 2018**? What percent of hives were treated? *(Choose all that apply)*

	Treatment	Percent of hives treated (%)
☐	Apistan (fluvalinate)	
☐	CheckMite+ (coumaphos)	
☐	Apivar (amitraz)	
☐	Thymovar (thymol)	
☐	Bayvarol (flumethrin)	
☐	65% formic acid – 40 ml multiple application	
☐	65% formic acid – 250 ml single application	
☐	Mite Away Quick Strips (formic acid)	
☐	Oxalic acid	
☐	Other *(please specify)* _________________________	
☐	None	

[2] Does not include nucleus colonies

[3] Viable : A viable colony, in a standard 10-frame hive, is defined has having 4 frames or more being 75% bee-covered on both sides.

4. Which method of treatment did you use for varroa control in late **summer/fall 2018**? What percent of hives were treated? *(Choose all that apply)*

	Treatment	Percent of hives treated (%)
☐	Apistan (fluvalinate)	
☐	CheckMite+ (coumaphos)	
☐	Apivar (amitraz)	
☐	Bayvarol (flumethrin)	
☐	Thymovar (thymol)	
☐	65% formic acid – 40 ml multiple application	
☐	65% formic acid – 250 ml single application	
☐	Mite Away Quick Strips (formic acid)	
☐	Oxalic acid	
☐	Other *(please specify)* ________________________	
☐	None	

5. Have you monitored your colonies for Varroa during the 2018 season?
   - ○ Yes – sticky board
   - ○ Yes – alcohol wash
   - ○ Yes – other (*please specify*) ______________________________
   - ○ No

6. Which method of treatment did you use for **nosema** control in **spring 2018**? What percent of hives were treated?

	Treatment	Percent of hives treated (%)
☐	Fumagillin	
☐	Other (*please specify*) ______________________________	
☐	None	

7. Which method of treatment did you use for **nosema** control in **fall 2018**? What percent of hives were treated?

	Treatment	Percent of hives treated (%)
☐	Fumagillin	
☐	Other (*please specify*) ______________________________	
☐	None	

8. Which method of treatment did you use for **American foulbrood** control in **spring 2018**? What percent of hives were treated? *(Choose all that apply)*

	Treatment	Percent of hives treated (%)
☐	Oxytetracycline	
☐	Tylosin	
☐	Lincomycin	
☐	None	

9. Which method of treatment did you use for **American foulbrood** control in **fall 2018**? What percent of hives were treated? *(Choose all that apply)*

	Treatment	Percent of hives treated (%)
☐	Oxytetracycline	
☐	Tylosin	
☐	Lincomycin	
☐	None	

10. To what do you attribute the main cause of death of your colonies? (Please check every suspected cause and rank the causes according to their relative importance.)

	Cause of death	Rank (1 = the most important)
☐	Don't know	
☐	Starvation	
☐	Poor queens	
☐	Ineffective Varroa control	
☐	Nosema	
☐	Weather	
☐	Weak colonies in the fall	
☐	Other (*Please specify*) _________________________	
☐	Other (*Please specify*) _________________________	
☐	Other (*Please specify*) _________________________	

Appendix B: List of Canada's Provincial Apiculturists

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