Ålands landskapsregering

PROTOKOLL

Nummer	Sammanträdesdatum
13	**1.3.2022**

Protokoll fört vid enskild föredragning

Social- och miljöavdelningen
Miljöbyrån, S4

Beslutande	Föredragande	Justerat
Minister	Veterinär	Omedelbart
Alfons Röblom	Maria Borgström	

....

Nr 28
Utrotningsplan för bikvalster Varroa destructor på Brändö
ÅLR 2021/6389
52 S4

Den 13.7.2021 och den 23.7.2021 konstaterades bikvalstret Varroa destructor på två olika biodlingar i Brändö kommun. Ett intensivt arbete har utförts för att stoppa spridningen, baserat på beslut från Ålands landskapsregering den 16.7.2021. För att återfå status som varroafri region inom den Europeiska unionen krävs en övervakning av området och parasiten. Där varje nytt utbrott enligt planen ska detekteras tidigt och åtgärdas.

Beslutet vidarebefordras till Jord- och skogsbruksministeriet för överlämning till Europeiska kommissionen. Planen är på engelska, men en sammanfattning på svenska kommer att återfinnas på landskapsregeringens hemsida.

Beslut
Antagande av utrotningsplan för djursjukdom hos bin med kvalstret Varroa destructor i Brändö kommun för godkännande av EU- kommissionen, enligt **bilaga S422E13**.

Tillämpade lagrum
Europakommissionens genomförandeförordning (EU) 2018/1882
Lag om djursjukdomar FFS 2021/76
Förvaltningslag för landskapet Åland ÅFS 2008/9

Bilagor
Eradication plan for Varroa destructor
Besvärsanvisningar

För kännedom
Livsmedelsverket
Ålands miljö- och hälsoskyddsmyndighet
Ålands biodlarförening

_____

Bilaga S422E13

Ålands landskapsregering

Eradication plan for Varroa destructor

REGARDING BRÄNDÖ MUNICIPALLITY

Dnr: ÅLR 2021/6389
Date: 29.12.2021

PB 1060, AX-22111 Mariehamn
registrator@regeringen.ax
+358 18 25 000
www.regeringen.ax

INFORMATION

1. GENERAL INFORMATION
   - 1.1 AREA TO BE COVERED BY THE ERADICATION PROGRAMME
   - 1.2 COMPETENT AUTHORITIES
   - 1.3 LEGAL BACKGROUND
   - 1.4 RULES ON MOVEMENT
   - 1.5 RULES ON NOTIFICATION AND MEASURES IN CASE OF SUSPICIONS AND OUTBREAKS
   - 1.6 RULES ON REGISTRATION OF APIARIES
   - 1.7 STRUCTURE OF APICULTURE ON BRÄNDÖ
   - 1.8 SURVEILLANCE PROGRAM
   - 1.9 VARROA DESTRUCTOR
2. INFESTATION IN BRÄNDÖ AND MEASURES TAKEN
   - 2.1 INFESTATION IN BRÄNDÖ AND MEASURES TAKEN TO ERADICATE VARROA
   - 2.2 LEGAL MEASURES TAKEN FOLLOWING THE INFESTATION IN BRÄNDÖ
   - 2.3 RESULT OF THE EPIDEMIOLOGICAL INVESTIGATION
3. ERADICATION PLAN
   - 3.1 GOAL
   - 3.2 RISK ASSESSMENT
   - 3.3 MONITORING
     - 3.3.1 BEE SAMPLING AND LAB ANALYSIS
     - 3.3.2 SENTINEL HIVES
       - 3.3.2.1 PROFESSIONALLY MANAGED
       - 3.3.2.2 PRIVATELY MANAGED
     - 3.3.3 VIRGIN QUEENS
   - 3.4 ERADICATION
   - 3.5 AWARENESS PROGRAMS
     - 3.5.1 REGISTRATION OF APIARIES
     - 3.5.2 RULES ON MOVEMENT
     - 3.5.3 MONITORING AND REPORTING
     - 3.5.4 NATURAL MITE FALL
     - 3.5.5 STICKY MAT
     - 3.5.6 DRONE COMBING
     - 3.5.7 SUGAR SHAKING
     - 3.5.8 OXALIC ACID TRINKLING
4. MOVING FORWARD

1. GENERAL INFORMATION

1.1 AREA TO BE COVERED BY THE ERADICATION PROGRAMME

The programme covers the municipality of Brändö, which is part of the autonomous region of Åland in Finland (see map in the attachment). Brändö municipality is located in the north-east part of Åland and is the closest part of Åland to mainland Finland. The distance between Brändö and mainland Finland is ~10km. There is a ferry connection between Brändö and Kustavi, which is part of mainland Finland.

1.2 COMPETENT AUTHORITIES

The government of Åland (Ålands landskapsregering) is responsible for implementing the programme. The Finnish Food Authority (FFA) is responsible for the restriction zone and for performing the laboratory tests.

1.3 LEGAL BACKGROUND

Åland was declared as a territory free of varroosis by Commission Implementing Decision 2013/503/EU on 11.10.2013. When Regulation (EU) 2016/429 on transmissible animal diseases (the Animal Health Law) became applicable on 21.4.2021 Decision 2013/503/EU was replaced by Commission Implementing Regulation (EU) 2021/620, Annex IX, where Åland was declared as a zone with disease-free status from *Varroa* spp. Finland declared Åland free from infestation with *Varroa* spp. by Ministry of Agriculture and Forestry Decree 327/2021 4 § on the same date, 21.4.2021.

The rest of Finland does not have a status as regards *Varroa* spp. and the mite is assumed to be present.

1.4 RULES ON MOVEMENT

According to Article 50 of Commission Delegated Regulation (EU), honeybees in any stage of their lifecycle including honeybee brood can only be moved to Åland from another Member State or zone with the status free from infestation with *Varroa* spp.

1.5 RULES ON NOTIFICATION AND MEASURES IN CASE OF SUSPICIONS AND OUTBREAKS

According to the Commission Implementing Regulation (EU) 2018/1882 infestation with *Varroa spp*, is categorised as an animal disease in categories C+D+E. *Apis* are susceptible species.

According to the European Union Article 18 of the Animal Health Law, Member States shall ensure that operators and other relevant natural or legal persons notify the competent authority where there are any reasons to suspect the presence of a category E disease in animals or where the presence of such a disease is detected in animals.

According to 19 § of the Finnish law Animal Health Act 76/2021 an operator or any natural or legal person taking part in the investigation, care, handling, transport, euthanizing or observation of an animal must notify the municipal veterinarian or the regional state administrative authority (In Åland, the government of Åland) of any suspicion or detection of a listed disease.

According to Article 8 of Commission Delegated Regulation (EU) 2020/689 the competent authority shall on suspicion of listed diseases investigate, to confirm or rule out the presence of that disease when there is a need to determine the health status of the Member State, zone or compartment thereof. The competent authority

shall confirm the outbreak of the disease when it has classified in an animal or a group of animals as a confirmed case.

The general measures to be taken in the case of a suspected outbreak of a category C disease are laid down in Article 76 of the Animal Health Law. The measures to be taken in the case of a confirmed outbreak of a category C disease are laid down in Article 80 of the Animal Health Law. There are no specific measures for outbreaks of *Varroa* spp.

According to 25 § of the Animal Disease Act 76/2021 the regional state administrative agency is responsible for the epidemiological investigation and measures to prevent the spreading of a category C disease and the Finnish Food Authority is responsible for all other measures. However, because of the autonomy of Åland the government of Åland is responsible for all the measures, except those related to zoning and laboratory testing, which are the responsibility of the Finnish Food Authority.

1.6 RULES ON REGISTRATION OF APIARIES

According to Article 84 of the Animal Health Law operators keeping terrestrial animals, including honeybees, shall, for their establishment to be registered, inform the competent authority of any such establishment under their responsibility and provide certain information specified in the Article. According to Article 93 of the Animal Health Law the competent authority shall register the establishment.

According to the Act on animal identification and registration 1069/2021 the operator shall provide the information digitally through an online service where possible or else provide the information by mail to the municipal bureau for rural areas. Beekeepers are required to register their apiaries and number of colonies in the FFA registry for animal husbandry (link available in Finnish and Swedish):

- https://www.ruokavirasto.fi/sv/odlare/djurhallning/markning-och-registrering-av-djur/djurhallarregister/

Digital registration is done via the following link (available in Swedish and Finnish):

- **https://epr.ruokavirasto.fi/front-page**

Registrations done via mail shall be sent to the municipal bureau for rural areas. Forms can be acquired from said bureau.
Registered information follows the same rules as for other terrestrial animals. This mainly concerns registration of geographic sites and the corresponding animal keeper. The information includes the following:

- Location – either beekeeper address or exact geographic coordinates
- Animal species – currently restricted to species only, excluding subspecies and various breeds
- Number of said species – for honeybees, number of colonies
- Date of registration – both starting and ending dates of when an apiary is registered and once it is deemed "passive". A passive apiary is one in which no bees are kept anymore, while active apiaries are ones in which live bees are present and being kept.

Record keeping – additional information on apiaries will be collected by their respective keepers using forms provided. This information is not to be shared in the registration process but is to be readily available if an inquiry for the data arises within the coming years of this program's duration.

1.7 STRUCTURE OF APICULTURE ON BRÄNDÖ

Currently, five known beekeepers reside in Brändö, with an additional one recently having ceased beekeeping for reasons unrelated to varroa. Only two of these five remaining beekeepers had their colonies registered during the time of varroa detection, whilst others were discovered as investigations into varroa were conducted in the area. As this program was written, the following apiaries within Brändö are known:

Beekeeper	Location	Total number of colonies (pre-varroa detection)	Current status
A	Jurmo	3 colonies within one apiary	Passive – Colonies moved to mainland Finland on 30/7 21
B	Åva	10 colonies distributed across 5 apiaries	Passive – Colonies destroyed by burning on 14-15/8 21
C	Åva	1 (+ swarm) within one apiary	Active – Colony tested negative during 2021 and thus remain
D	Torsholm	1 (+ 2 yearly swarms) within one apiary	Active – Colony tested negative during 2021 and thus remain
E	Asterholma	1 (+yearly swarm) within one apiary	Active – Colony tested negative during 2021 and thus remain

1.8 SURVEILLANCE PROGRAM

In 2013 a risk-based surveillance program was established for Åland with the aim to prove absence of varroosis. The risk for introduction is greatest around harbors and the airport. Originally the plan has been to inspect and sample all apiaries within a 5 km distance from the airport or the main harbors (high risk zones), with 10% of randomly chosen apiaries in other areas to be inspected and sampled once a year in July. However, for unknown reasons, these protocols do not seem upheld according to available data. In 2020, 18 apiaries owned by 18 different beekeepers were sampled in high-risk zones across Åland, yet registry data claims 31 apiaries owned by 29 beekeepers reside in high-risk zones on Åland.
The inspections and sampling are carried out by authorized inspectors. The sample is 300 adult honeybees, and it is analyzed by the Finnish Food Authority by the washing method.
Brändö was originally designed as a high-risk zone, but that status was removed for an unknown reason, possibly through a misunderstanding. Nevertheless, the only professional apiary in Brändö has been inspected and sampled every year.

1.9 VARROA DESTRUCTOR

Varroa destructor is a parasitic mite primarily parasitizing on various species of honeybees (genus *Apis*) throughout near all regions of the world. The successful spread and establishment of this mite (henceforth referred to as "varroa") is partially due to the emergence of international honeybee trade industry, causing varroa originally native to Asia able to spread to other continents.

The population dynamics of varroa are heavily influenced by many factors, such as temperature, honeybee colony structure and time of year. Females of the species attach themselves to both adult and larvae honeybees (henceforth referred to, interchangeably, as "hosts"), feeding of their hosts fat body. Varroa can parasitize on multiple hosts within its lifetime, making transmission of diseases between bees a very likely outcome. Some diseases of note transferable by varroa include:

- Deformed Wing Virus (DWV)
- Acute Bee Paralysis Virus (ABPV)
- Sac-Brood Virus (SBV)

Varroa typically infect larvae hosts during their 5th instar (8-9 days old) when brood cells have been sealed. Once morphed into reproductive adults, the varroa females disperse from the brood cell via hitchhiking on their bee hosts and are, undenounced to the host, transported to brood cells. The female varroa then lays her eggs on the larvae within the new brood cell which can begin parasitizing their new host during development until they too morph into fertile adults and disperse anew. The generational time of varroa is affected by various factors, many of which still elude scientist, though temperature and outside humidity seems to play some part in it. Also, it has been well established for decades that varroa shows preference for drone brood as hosts over other clades within a honeybee colony. This offers vital insight into both monitoring and extermination tactics, as brood development within colonies are, relatively, easier to trace compared to workers.

2 INFESTATION IN BRÄNDÖ AND MEASURES TAKEN

2.1 INFESTATION IN BRÄNDÖ AND MEASURES TAKEN TO ERADICATE VARROA

On 13.7.2021, as part of the established monitoring program two honeybee colonies located in Åva (Brändö municipality, see Fig 1) where tested positive for varroa presence. The owner of these colonies owned additional colonies at other nearby sites. These hives were all subsequently destroyed by burning on 14-15.8.2021. Further investigation of surrounding sites (15km radius) revealed three additional non-registered apiaries owned by separate beekeepers. Sampling of colonies within these apiaries provided negative results (no detectable varroa presence) in two of these apiaries, and one with positive results on 23.7.2021. This apiary was in Jurmo, north of Åva (see Fig 1), and had a significantly higher abundance of varroa in its hives. These were subsequently shipped off to mainland Finland (an already varroa-infested region) based on a permission from the government of Åland on 30.7.2021. The permission included measures to prevent the risk of transmission of varroa during transport.

2.2 LEGAL MEASURES TAKEN FOLLOWING THE INFESTATION IN BRÄNDÖ

On 26.7.2021, following the findings in Brändö, the Finnish Food Authority (FFA) declared Brändö a restricted zone based on 26 § of the Act on Animal Diseases (76/2021). The restricted zone is still in force. It prohibits the movement of honeybees in any stage of their lifecycle including honeybee brood as well as hives, material and equipment that have been in contact with honeybees from establishments in Brändö. It also prohibits the movement of honeybees in any stage of their lifecycle including honeybee brood to establishments in Brändö. Derogations can be granted by the government of Åland.

On 9.9.2021 Brändö municipality was excluded from the zone with the status free from infestation with Varroa in Finland by Ministry of Agriculture and Forestry decree 819/2021.

On 27.10.2021 the European Commission amended Commission Implementing Regulation (EU) 2021/620, Annex IX, to exclude the municipality of Brändö from the list of Member States or zones with the status free from infestation with varroa.

2.3 RESULT OF THE EPIDEMIOLOGICAL INVESTIGATION

The origin of varroa found on Åland was not found by the government of Åland, though available data indicates introduction from Finland being the most likely explanation. Whether or not infected bees in Åva came from Jurmo or dispersed during transportation is difficult to say, though analysis of varroa infestation rates in Jurmo performed by FFA showed hives in Jurmo had a higher number of infected honeybees then those in Åva. Thus, it would seem infected bees were transported into Jurmo and spread to Åva from there. The varroa-positive bees from Jurmo were originally purchased from another apiary in Jurmo which has been empty since 2020 for unrelated reasons. It has not been established with certainty where the now empty apiary purchased the bees. It is thus possible that they were brought in illegally from mainland Finland. Other possible transmission routes are that infected bees were brought in from mainland Finland accidentally by car or that infected bees came by themselves on the ferry.

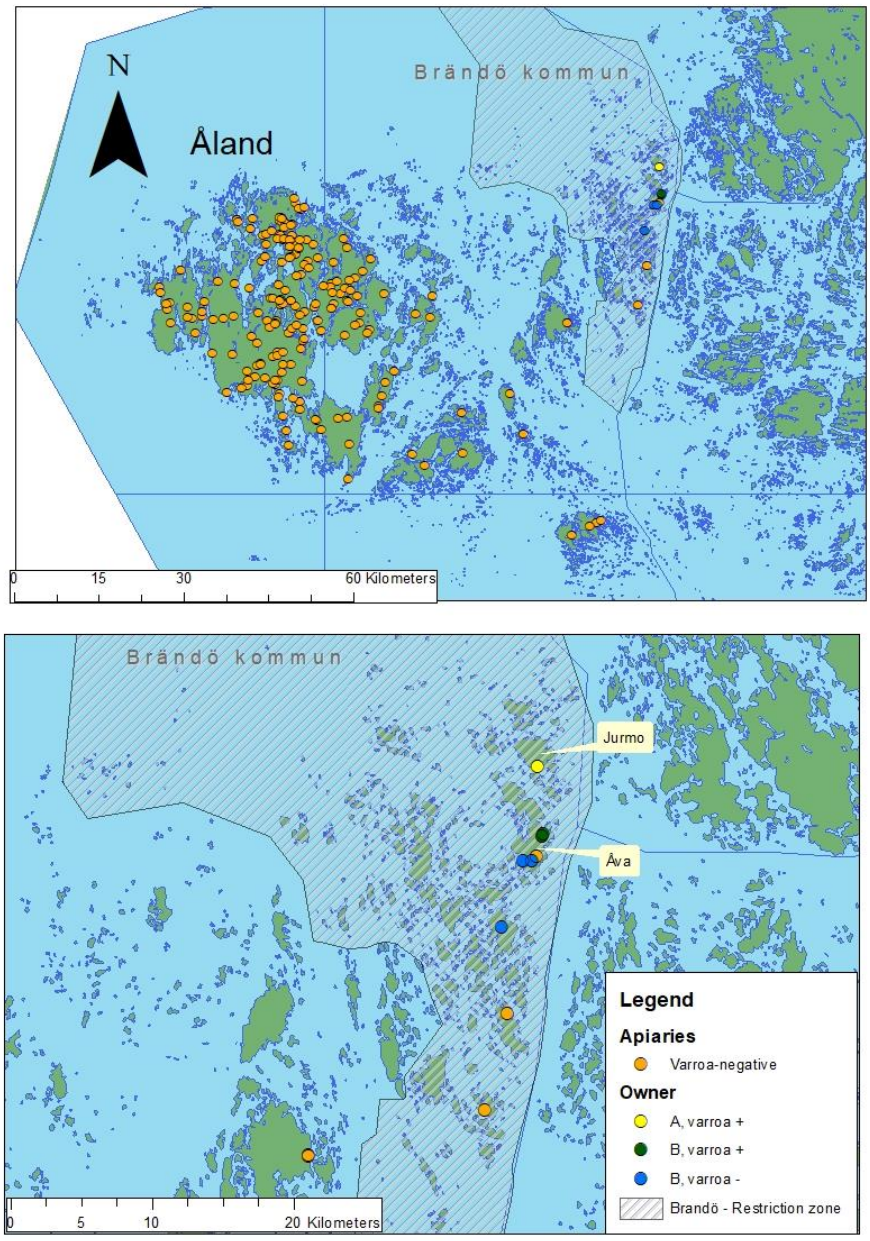

Fig 1. Map of Åland on the west coast of southern Finland, with established restriction zone (Brändö municipality) highlighted. Honeybee colonies (apiaries) registered in the FFA system are plotted, though many other non-registered hives are likely scattered and not yet accounted for. Varroa-positive apiaries (discovered in summer 2021) are denoted by "+" while varroa-negative apiaries (but owned by the same beekeeper owning an infected colony) are denoted with "- ". Owners of apiaries are denoted as in table 1.

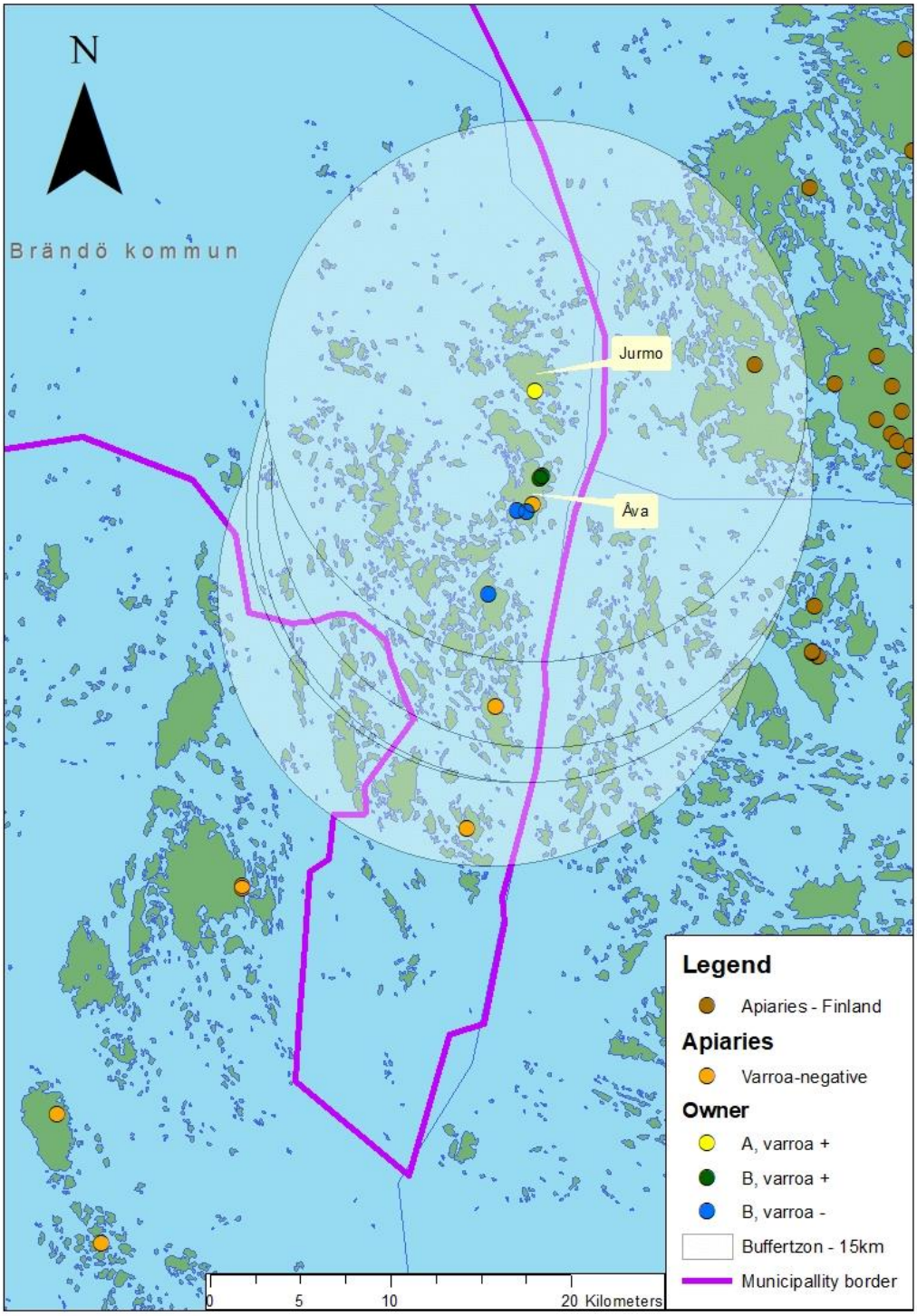

Fig 2. Map of Brändö, showcasing buffer zones (15km) surrounding infected apiaries or hives with extremely high likelihood of infection. Also displayed are registered apiaries on mainland Finland, showcasing their proximity to apiaries in Brändö. Though varroa-status for these hives is not available, they highlight risks for possible transfer from the mainland if they are in fact infected. Varroa-positive apiaries (discovered in summer 2021) are denoted by "+" while varroa-negative apiaries (yet owned by the same beekeeper owning an infected colony) are denoted with "- ". Owners of apiaries are denoted as in table 1.

3 – ERADICATION PLAN

Table 2. Annual life cycle of honeybee colony and varroa with applied methods to be used in said periods. Exact timing of varroa response differs depending on outside factors such as colony size, outside temperature and more. Survey methods and eradication response needs to be adjusted depending on time of year and current state of varroa. Method background and use is described further below, with certain methods meant to be used by professionally trained personal hired by the government of Åland and others by private beekeepers educated on proper monitoring managements. Unless specified otherwise, methods described are to be used once per month, with additional usage within the same month being redundant.

Month	**Honeybee colony**	***Varroa destructor***	**Monitoring method (Brändö)**
March	Bees emerge Nectar Flow commences	Reproduction starts Low levels	
April		Presence in both capped cells and on some adult bees Low levels	Natural mite fall / sticky mat (2^{nd}-3^{rd} day for 2 weeks/1 week, respectively)
May	Honey production First drones are born	Presence in both capped cells and on adults Increased levels	Natural mite fall / sticky mat (2^{nd}-3^{rd} day for 2 weeks/1 week, respectively) Drone combing – If available, insert drone frames for easier drone combing following months Sugar shaking
June - August	High likelihood of swarming Honey harvesting Nectar flow seizes (typically August, but dependent on outside temp.) Winter feeding starts	Presence in both capped cells and on adults Increased levels	Natural mite fall / sticky mat (2^{nd}-3^{rd} day for 2 weeks/1 week, respectively) Drone combing Sugar shaking Virgin queens Lab sampling (EU protocols: during August by authorised inspector)
September	Swarming decreases.	Presence in both capped cells and on adults Increased levels	Natural mite fall / sticky mat (2^{nd}-3^{rd} day for 2 weeks/1 week, respectively) Sugar shaking
October	Over-wintering begins	Fewer brood cells = majority of mites attached to adult bees High levels	
November	Overwintering Low activity	Outside brood cells Highest levels	Natural mite fall / sticky mat (2^{nd}-3^{rd} day for 2 weeks/1 week, respectively) + Oxalic acid trinkling

December	Overwintering Low activity	Outside brood cells Highest levels	Natural mite fall / sticky mat (2^{nd}-3^{rd} day for 2 weeks/1 week, respectively) + Oxalic acid trickling (on hives not trinkled previously in November)

3.1 GOAL

The intention is to create qualifications for Brändö to regain its varroa-free status by the year of 2024, or when the Commission declares so. The aim of the eradication plan is to monitor the situation as regards varroa in Brändö and eradicate any outbreaks that may occur. The plan also includes measures to increase awareness of the disease and to improve compliance with the legislation.

3.2 RISK ASSESSMENT

Risk of varroa remaining in kept bees:
Despite current monitoring methods for detecting varroa, false negatives can be quite common during initial years following infestations in colonies. It can often take a full year or two before adult varroa have become abundant enough to have a high enough likelihood of detection. It is therefore difficult to properly assess whether or not apiaries inside Brändö are truly free of varroa or not, given their geographic proximity (<15km radius) to colonies with confirmed infestations. Given the goals of the program, it is assumed that all apiaries located within 15km from infected sites might be infected.
Risk of varroa remaining in wild bees:
Likelihood of wild social bees (genus *apis*) being present in Brändö are low. Wild swarms (conjugation of adult bees outside hives during summer periods) are however fully plausible to occur, as well as unaccounted (unregistered) apiaries remaining in Brändö. Monitoring methods such as usage of virgin queens (**see further below**) will be used to investigate possible presence of these swarms in Brändö.
Risk of reintroducing varroa:
Given its proximity, mainland Finland stands as the highest risk for introduction of additional varroa. Methods will be implemented to monitor this situation and prevent further influx of varroa. This includes educational material and outreach to both local beekeepers and travelling civilians, as well as the addition of sentinel hives (**see further below**).

3.3 MONITORING

For Brändö to achieve the status of a zone free from infestation with *Varroa spp* intensive monitoring needs to be carried out yearly and throughout the year to prove the absence of Varroa. Given the well documented life cycle of varroa, monitoring techniques can vary depending on the time of the season. The monitoring programme described as follows is mainly derived from the EU programme on the surveillance of honeybee colony mortality (Epilobee project; see EU legislation Annex V, Part III, section 1) and is to be performed by trained personal, e.g., a contracted veterinary or health agent. For a detailed view on protocols unchanged in the following plan, we refer the reader to the original document by the European Reference Laboratory on

Previous protocols by the EU serves the purpose of investigating overall health and diseases in apiaries. This eradication program builds upon the EU protocols with a particular focus on detection of varroa and varroosis, as well as overall colony mortality rates which function as indicators of possible varroa infestations. Following are methods to be implemented in the eradication program and continued monitoring of Brändö to be used by professional personal (contracted veterinary or health agents). Some methods are re-used from earlier EU protocols, with updated/altered information and application described in detail:

3.3.1 – BEE SAMPLING AND LAB ANALYSIS

Background:
This method is the main form of monitoring used until the detection of varroa in Brändö in 2020 and was the means in which the infestation was originally discovered. The authorised inspector takes a sample of adult honeybees from a hive during the peak of expected varroa counts (for Åland during August), washes them with alcohol and afterwards identifies **varroa infestation rate** in the colony by counting dead, detached varroa in the lab (FFA lab in Kuopio). Honeybees sampled are killed with this method, but the observer can take a relatively larger sample size compared to other methods and assertively identify varroa (if present) inside the lab afterwards.
Required equipment:

- Protective clothing
- Glass jar (~170g)
- Alcoholic wash (70%)
- Microscopic lens

Procedure:
Near identically to the protocols used by the current EU bee health monitoring program (**see Epilobee project**):

- https://www.oie.int/app/uploads/2021/03/3-02-07-varroosis.pdf

Sampling will be done on all known hives located within Brändö. From these, collect ~300 honeybees and take them into the lab. Make sure the queen is not located on the frames from which bees are being collected. Bees are taken into lab where they are washed with alcohol and stirred for ~10 min. Once killed, varroa are separated from the bees and can be examined if present.
Timing:
Samples will be taken once a year, in August, similar to previous monitoring protocols, though precise timing of visitations will be adapted to local climates and status of apiaries in the specific area to ensure life-cycle stage of monitored colony is accurate.
Report:
Data will be reported as number of varroa per 100 bees per colony, as per the previous EU protocols used. **Please note**: any varroa detected is cause for alarm, as Åland aims to become a varroa-free region.

3.3.2 – SENTINEL HIVES

3.3.2.1 – Sentinel hives (professionally managed)

Background:
This method uses honeybee hives strategically placed at various locations to function as "warning signals" for possible influx or through traffic of varroa infected insects. By placing a colony inside a high-risk zone, such as a harbour port, there is a higher likelihood that any influx of varroa from outside the region will spread to this colony first. These would require more regular checks than the typical monitored hive. The method has proven very useful in the Oceanic, where Australia have used it to safeguard against various honeybee related diseases, including varroosis, with great success so far.
Required equipment:

- Honeybee colony with confirmation of no previous or current infection of varroa + hive.
- Signs with relevant info for passers-by
- Protective clothing
- See section on awareness program (**3.5**) for additional material required as provided for natural mite fall (**3.5.4**), sticky mat (**3.5.5**), drone combing (**3.5.6**) and oxalic acid trinkling (**3.5.8**).

Procedure:

Hives will be placed at strategic locations (see Fig 3.) in which they are likely to become infected by varroa, if influx into the region would happen. These strategic locations were selected based on discussion with local honeybee experts and likelihood of varroa introduction given fairway data taken from the Finnish Transport Infrastructure Agency. When checking the sentinel hive, use natural mite fall / sticky mat sampling (**3.5.4/5**) combined with oxalic acid treatment (**3.5.8**) and drone combing (**3.5.6**). In addition, bee samples with follow-up lab analysis will be taken, just as for other sampled colonies (**see 3.3.1**).

Timing: Check-ins will follow same guidelines as those of the other monitoring methods, specifically natural mite fall (**3.5.4**), sticky mat (**3.5.5**), drone combing (**3.5.6**), oxalic acid trinkling (**3.5.8**) and bee sampling (**3.3.1**). throughout the entire season (1/5 – 30/9). See **Table 2.**

Report:

Reported data will be that from other sampling methods: drone combing (**3.5.6**) and oxalic acid treatment (**3.5.8**), combined with natural mite fall and sticky mat (**3.5.4/5**), as well as bee sampling and lab analysis (**3.3.1**). **Please note**: any varroa detected is cause for alarm, as Åland aims to become a varroa-free region.

3.3.2.2 - Sentinel hives (privately managed)

Background:

This method utilizes volunteer beekeepers in Brändö to repurpose their private colonies as sentinel hives. This would include near identical management as a typical beehive and would not infer too much workload on the beekeepers themselves. However, colonies in use need first be guaranteed as to not have any varroa present. Therefore, all registered colonies in Brändö to be used as sentinel hives will first be removed (destroyed or traded) and replaced with fresh colonies purchased from areas guaranteed to be free of varroa and put in the care of the beekeeper who had their previous colony removed.

Required equipment:

Same material needed as for professionally managed hives (**3.3.2.1**).

Procedure:

Local beekeepers in Brändö will be asked to trade off their current, possibly infected, colonies with fresh colonies from regions guaranteed free of varroa. Compensation is to be offered to those who choose to destroy their personal colonies for this purpose. Once old hives have been removed and swarming honeybees can be confirmed as absent using virgin queen monitoring (**3.3.3**), fresh hives will be installed. Funding for these hives is still being discussed. Afterwards, the private beekeeper will be instructed by handout information and educational seminars, provided by the local beekeeper association, on how to properly monitor their new sentinel hives. When checking the sentinel hive, the same procedures as for professionally managed hives will apply (**3.3.2.1**)

Timing:

Check-ins will follow same guidelines as those of the other monitoring methods used to monitor professionally managed sentinel hives, specifically natural mite fall (**3.5.4**), sticky mat (**3.5.5**), drone combing (**3.5.6**), oxalic acid trinkling (**3.5.8**) and bee sampling (**3.3.1**). throughout the entire season (1/5-30/9). See **Table 2**.

Report:

Reported data will follow the same guidelines as for professionally managed hives (**3.3.2.1**).

3.3.3 – VIRGIN QUEENS

Background:

This method is similar to sentinel hives **(3.3.2)** as it serves to warn the presence of unaccounted bees in the area. A virgin queen with low worker ***(100-200psc)*** load is placed in a ***mating beehive*** at strategically selected locations with no knowledge of any other bees in the area. A mating beehive is essentially a microcolony for honeybees that contains a virgin queen, accompanying workers (2-300 bees depending on hive size), food storages and most importantly no drones. The queen is then checked to see if she has been mated or not - just once after 20-25 days is OK. A mated queen confirms the presence of drone honeybees in the area, which is an indication of honeybee swarms being nearby that could be either remnants of older colonies from previous years (e.g., wild bees) or an indication of a colony from an unregistered apiary in the area. These swarms could then be located and captured to reduce the chance of them functioning as vectors of varroa, while simultaneously allow non-registered apiaries to be discovered and added to the FFAs registry.

Required equipment:

- Mating hive + accompanying workers (120-170g)
- Virgin queen
- Protective clothing

Procedure:

First select a region in which previous swarming are expected to have occurred, without any known active apiaries nearby. Such an area can be inferred from local beekeepers and reports of swarms from previous years. Place a virgin queen with a mating hive and accompanying workers (120-170g) in the selected spot and leave them. Make sure there are no drones present in the hive before placing it. Check after 20 - 25 days if queen has mated, by checking if any new broods are being produced. If so, remove the hive and begin searching the nearby area for swarming honeybees or un-registered colonies. The observer is recommended to confer with local beekeepers or experts on the subject for relevant methods for tracking down swarms. Swarms may also be detected by locals that may call and report any swarming honeybees on their land. Once completed colony should be destroyed.

Timing:

This method is best suited during periods of high swarming intensities, such as mid-summer. Exact timing will depend on likelihood of swarming intensities given reports from previous years, but ideally in between June-August. Furthermore, sentinel hives (**3.3.2**) are expected to be deployed once swarms have been confirmed absent from the respective areas, meaning the ideal timing of certain virgin queen sample sites will also be dependent on timing restrictions for when these sentinel hives need to be deployed at the latest.

Report:

Observer should note down time the mating hive has been deployed, including date of deployment (starting date) and data of checking (end date). Note that trial period ends whether the queen is mated or not once the sampling period ends. If queen is mated, begin search of nearby swarms. Otherwise simply report it at such and remove the mating hive from the site.

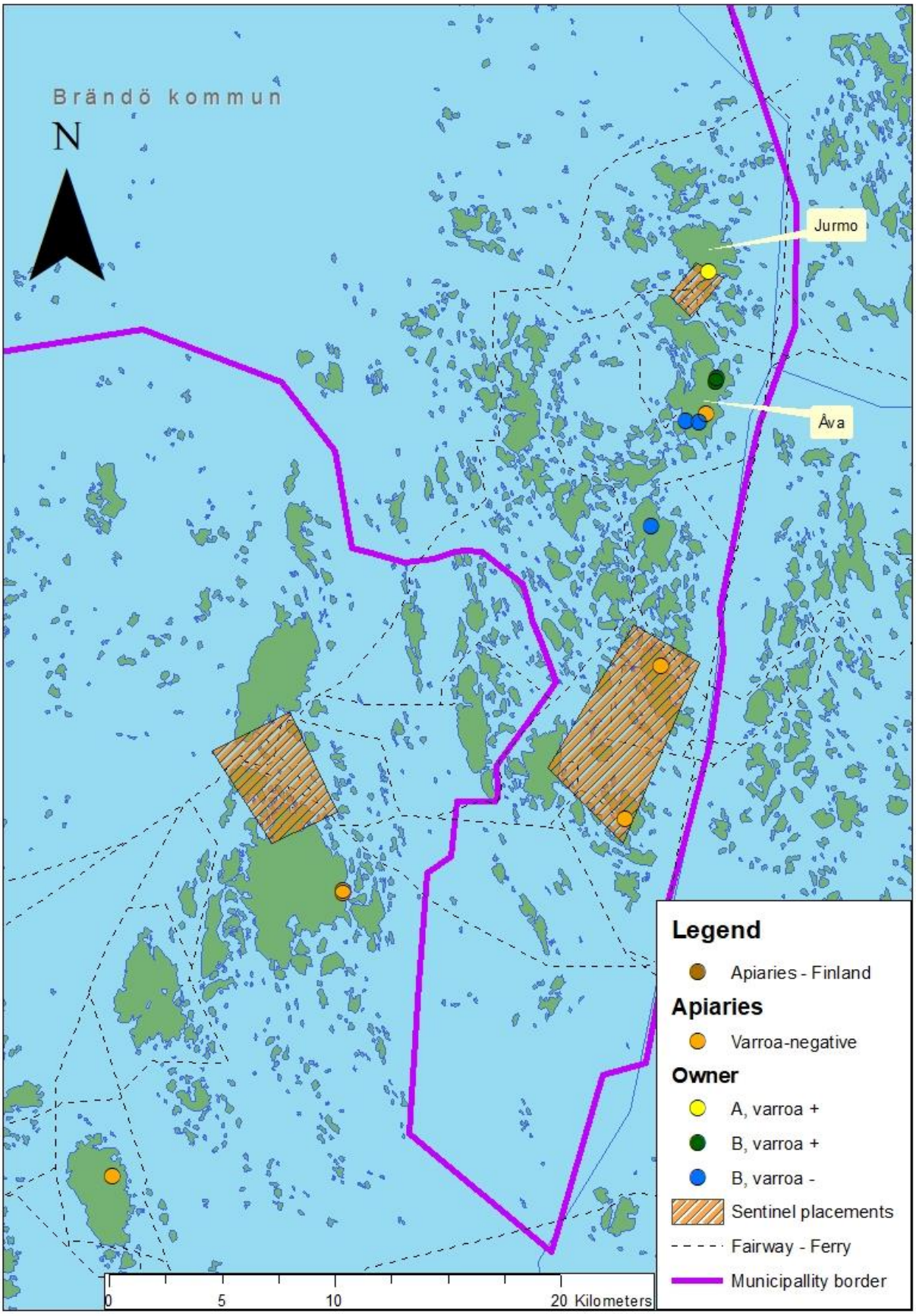

Fig 3. Map of Brändö, showcasing planned deployment areas for sentinel hives in 2022 and onward. Exact locations for hives will be decided at a later data, once funding and additional resources have been properly secured. Varroa-positive apiaries (discovered in summer 2021) are denoted by "+" while varroa-negative apiaries (but owned by the same beekeeper owning an infected colony) are denoted with "-". Owners of apiaries are denoted as in table 1.

3.4 – ERADICATION

The government of Åland will order any colonies with confirmed presence of varroa to be disposed of as soon as possible without risking any potential spread to nearby apiaries. This can be done either by destroying colonies with confirmed infestations by burning or, provided the government of Åland grants a permission and based on measures to prevent the transmission of the disease during transport, moving them to already infested regions in mainland Finland. The decision ultimately depends on the preferences of the beekeeper, if the colony is removed from Brändö. In the case of colony having to be destroyed, compensation will be offered to the beekeeper.
If varroa is confirmed to be present in a colony within an apiary, all colonies in the same apiary will be removed as quickly as possible. Any hives within a 15km radius of infected apiaries, or apiaries owned by beekeepers also owning these infected colonies, will also be removed, as follow-up tests on those would likely only provide false-negative results as varroa mites typically require many years to begin being noticed. Beekeepers owning these colonies have been contacted by representatives from the government of Åland to open a discussion on having them removed. So far (as of Dec 2021), all of those contacted seem willing to follow-through and will cooperate on this transition in 2022 and possibly onward.
Report:
Following information is to be noted down if an apiary is removed: date of varroa discovery; date of removal (either destruction of hive or transported to infected area); geographic coordinates (both of apiary and, if moved, location of buyer); size of apiary where colony discovered; size of colony (I.e., weight, if available). Collected data can prove useful for modelling future viral outbreaks of varroa if they were to return.

3.5 – AWARENESS PROGRAM

Of most importance regarding the eradication program is the continued support and communication with local beekeepers. This will mainly be composed of a more systematic encouragement of private beekeepers registering their hives, while simultaneously providing seminars and educational material on how to monitor, identify and handle varroa. Public education and training will be provided by the local beekeeper association in cooperation with the government of Åland when necessary. In addition, owners of active honeybee hives currently located in Brändö will be asked for possible cooperation for a long-time monitoring scheme (e.g., sentinel hives). This will ideally provide means for both private beekeepers to maintain a healthy hobby while at the same time monitoring for possible infestation of varroa.

3.5.1 – REGISTRATION OF APIARIES

This will be a main driving factor in the eradication plan, as the current status of registered apiaries is not representative of the entire beekeeper community and monitoring is not effective if all apiaries are not registered.

Detailed information on how the registration process is done is available to the public, though more effort will be done to spread this information. The Finnish Beekeeper Association and local Beekeeping Association of Åland, in collaboration with the government of Åland, will assist to ensure all apiary data are saved in one location.

Registered beekeepers on Åland are numbered at ~120, with 1200 total colonies, yet the infested hive on Jurmo, as well as some of those tested negative in the surrounding area, where not registered. More proper regulation and categorising of beekeepers on Brändö are required in order to properly track any future possible invasions.

3.5.2 – RULES ON MOVEMENT

Given the possibility of illegal movement as a source of the outbreak, it is important to consider general public knowledge on regulations on movement. It is quite clear that varroa infestation is not wanted by any party and additional public outreach and education on varroa biology and spread will be vital to reduce the risk of transboundary spread, especially as beekeeping is becoming a more common hobby among untrained people and hence requires proper information and education on the severity and risks of varroa infestations.

3.5.3 – MONITORING AND REPORTING

Currently, the government of Åland is collaborating with the local beekeeper association for improved communication and establishment of standardized protocols which can be employed by professional and hobbyist beekeepers alike. Monitoring schemes are based upon the EU bee health monitoring programme with slight alterations to suit the current ecological landscape of Åland and suggests viable methods for both professional personnel and private beekeepers.

The goal of the methods is to provide means for both experienced and beginner beekeepers to properly assess possible presence of diseases in colonies. So far, local beekeepers have not been instructed to assess their hives, with only professional crew arriving at registered apiaries, collecting samples and running analysis in the lab. Although these methods are the most reliable means of investigating presence of varroa in hives, both time and resources limit who are available to perform them. Hence, a collaboration and outreach program has been established to educate local beekeepers to personally investigate their apiaries for varroa, while remaining economically reasonable for them without consuming too much of their time.

3.5.4 – NATURAL MITE FALL

Background:
This method uses a specialized compartment placed in the bottom of honeybee hives. The compartment is sealed off from the top with fine bars, preventing honeybees to enter but allowing varroa to fall through if detached from bees. By performing frequent check-ins, the beekeeper can check any presence of varroa that naturally fall off honeybees. These mite-falls can be induced in combination with oxalic acid treatment (see further below).
Required equipment:

- Protective clothing for working around honeybees
- Bottom compartment (either self-constructed or purchased)
- Mesh wiring
- Magnifying lens

Procedure:
Given that all hives within an apiary are outfitted with bottom compartments, all hives should be checked. Examine each compartment of apiaries once every week for fallen varroa. As various factors can cause fallen mites to disappear from these bottom compartments, they should be checked as regularly as possible to increase likelihood of detection. Be mindful varroa can be difficult to tell apart from other non-viral arthropods or debris found in bottom compartments as well. If unsure, save the contents and examine them in another, quieter environment, like indoors.
Timing:

As this is a non-invasive method, sampling can be performed the entire year at regular intervals. Contents should be checked every 2nd-3rd day for 2 weeks, followed by 2 weeks of non-investigation, throughout the entire season (1/5 – 30/9), though this will depend on available time for beekeepers examining their hives.

Report:

After checking a colony, note down number varroa found in its compartment (even if zero varroa are found). Observer should also note down number of varroa per colony/apiary per day, in order to help estimate spread and severity of possible future infestations. As daily varroa counts are the norm when using this method, the observer should note down the average number of mites during their weekly checks. For example, finding 10 mites should be noted down as (10/7 = 1,4 varroa per day). **Please note**: any varroa detected is cause for alarm, as Åland aims to become a varroa-free region.

3.5.5 – STICKY MAT

Background:

This method is near identical to natural mite fall (**3.5.4**) but differs in that, for a higher price point, beekeepers can use mats with a sticky, non-toxic substrate that prevents mite from moving off the bottom compartment once fallen off. Furthermore, ants and earwigs are common scavengers around honeybee hives. Though commonly beneficial in consuming varroa, they can skew results by eating fallen varroa in the bottom compartments before they are seen by the observer. Sticky mats impede ants and earwigs movement, making it more likely for varroa to remain untouched until discovered by the observer during scheduled checks. Although more costly to purchase than a normal bottom compartment for beehives, beekeepers can construct these on their own if necessary.

Equipment needed:

- Protective clothing for working around honeybees
- Bottom compartment (either self-constructed or purchased) with 3mm mesh wiring
- Magnifying lens
- If bottom compartment is self-constructed, additional material required would include:
    - Thick piece of white cardboard
    - Petroleum jelly, or similar adherent material for temperate climates
    - Mini-paint roller

Procedure:

Constructing self-made sticky mat (instructions lifted from Plant Health Australia):

1. Take a thick piece of white cardboard that is large enough to cover the majority of the bottom board of your beehive.
2. Cut the cardboard to fit the majority of the middle of the bottom board. Width (30cm) and length (46cm) should roughly be the size for an 8-frame and 10-frame hive. Important: Cardboard might bend in wet weather and block the hive entrance. This can be circumvented by either cutting a V into the cardboard and place this near the entrance or cutting the cardboard short enough so that it is not within 10cm of the entrance.
3. Apply petroleum jelly, or similar adherent material, to the sticky may mat with a mini-paint roller.
4. At moderate temperatures, petroleum jelly serves as an excellent adhesive for sticky mats.
5. Cut the 3mm gauze wire mesh so that it covers the sticky mat surface.
6. Once your sticky mat and gauze wire mesh have been prepared, light a smoker, open the hive and remove the bottom box of the hive off the bottom board.
7. Using your hive tool, scrape away any debris or wax that may have accumulated on the bottom board.
8. Place the sticky mat (sticky side up) on the bottom board, and cover with the gauze wire mesh.

If purchasing sticky-mat, or already own one, follow procedures described for natural mite fall (**3.5.4**).

Timing:

Like natural mites fall, observers can check bottom compartments at longer intervals since mites are less likely to disappear between checks. Therefore, observers should check their hives every 2nd-3rd day, every week throughout the whole season (1/5 – 30/9).

Report:
After checking a colony, note down number varroa found in its compartment (even if zero varroa are found). Observer should also note down number of varroa per colony/apiary per day, in order to help estimate spread and severity of possible future infestations. As daily varroa counts are the norm when using this method, the observer should note down the average number of mites during their weekly checks. For example, finding 10 mites should be noted down as (10/7 = 1,4 varroa per day). **Please note**: any varroa detected is cause for alarm, as Åland aims to become a varroa-free region.

3.5.6 – DRONE COMBING

Background:
This method is quite straightforward and only requires a specialized comb which is easily purchasable at low cost. The comb is used to "scoop" a drone frame with capped cells, picking up drone larvae in the process and killing them. This allows one to observe any possible mites feeding off the larvae, which are relatively easy to spot against the white surface of a honeybee larva. Despite the invasiveness of this method, little harm is done to the colony as drones are easily expendable and do not directly interfere with colony mortality.
Required equipment:

- Protective clothing
- Drone brood frame
- Capping scratcher, wide shearing comb or uncapping fork
- White paper or cardboard
- Magnifying lens

Procedure:
Randomly select a third of colonies inside the apiary. In each of these colonies, select three frames with each a relatively high density of capped drone brood cells; ~100 cells should be uncapped per colony sampled. Alternatively, depending on available income for the private beekeeper conducting the monitoring, specialized drone frames can be inserted next to brood frames in the colony for easier collection of drone cells later. Drone cells are easy to distinguish from workers, even for beginner beekeepers. **Please note;** ensure the queen is not located on the same frame to reduce risk of harming her! Use your cappings scratcher or other sharp object to shear of one singular segment of the capped cells and picking up drone larvae. Place these on a white background, such as paper or cardboard, and examine the larvae for varroa, visible as brown dots. Larvae are killed by this method, so if no varroa are detected on the larvae they can be disposed of as the observer wishes. Also ensure to check bottom of uncapped cells for any varroa that might have been unattached to larvae.
Timing:
Drone broods are typically produced at their highest quantities during spring and reduces as the seasons goes on. Hence, this method should only be applied during late spring (May– June) and performed once a week. This method can also be performed in conjunction with regular hive inspections during said period. In addition, if specialized drone frames are to be inserted, this are to be so during May as the queen begins laying drone eggs.
Report:
Note down the number of mites discovered per larvae, per frame, even if no varroa are found. The following data points should be noted down: varroa per larvae; varroa per colony; varroa per apiary. **Please note**: any varroa detected is cause for alarm, as Åland aims to become a varroa-free region.

3.5.7 – Sugar shaking

Background:
This method is widely used as a cost-efficient and relatively simple way of checking for adult varroa in hives. A sample of adult worker bees are taken ***(cca 300pcs)*** and placed inside a jar containing sugar. The sugar adheres to the bees without harming them and causes varroa to dislodge. After gently shaking the jar, bees and varroa should be separated and the content can be sieved to check for varroa. Effectiveness can vary as either many

samples need to be taken from one colony, or the colony need to already be heavily infested, for the sample to have a high enough likelihood of containing any mites.

Required equipment:

- Jar (preferably plastic) about 500 – 750 grams in size and lid with 3mm mesh wiring
- Pure icing sugar
- Cup (about 250 mL)
- Tablespoon
- Newspaper or large plastic sheet
- Container to hold water (e.g., small white bucket) or white sheet of paper/cardboard
- Protective clothing
- Magnifying lens
- Filter paper (e.g., coffee filter) or fine sieve

Procedure:

Randomly select a third of colonies inside the apiary. In each of colonies, select a frame in the first honeybox above the brood box in the hive containing a high density of bees (~300). If no honey box available, pick from brood box but be observent not to pick the queen. Shake honeybees loose from the frame (ensure not to shake nectar drops with honeybees) onto a piece of paper or plastic sheet and transfer them over to a glass or plastic jar (500-750 gram). **Please note**: ensure the queen is not located on the same frame to reduce risk of harming her! Once collected, pour sugar into the jar using a sieve, then begin vigorously shaking the jar (mesh wiring turned up). After 2-3 minutes, place a plastic bag or new jar on top of the other and tap the container upside down so that all powdered sugar with possible varroa drops into the new container. Turn the two containers over and around a few times to ensure as much content as possible is sieved through. Once satisfied, release the bees back into their colony and investigate the sieved contents for possible varroa. Water can be added to contents to quickly dissolve sugar. If suspected contents have been caught, either confirm them as varroa using microscopy or by contacting professional help at the FFA or local beekeeper association.

Timing:

This method is most efficient during warm climates and when infestations are already at high levels. It is therefore recommended to be carried out during the summer period (June-September), as samples done earlier in spring might either be too cold or have not high-enough infestation levels to provide any meaningful results.

Report:

The observer will note down number of varroa found per colony, even if no varroa are discovered. Summarized data will be presented as: varroa per colony; varroa per apiary. **Please note**: any varroa detected is cause for alarm, as Åland aims to become a varrao-free region.

3.5.8 – Oxalic acid trinkling

Background:

Oxalic acid treatment is an old and efficient method for monitoring and/or killing varroa without any significant effect on honeybees. At correct concentrations, the compound is toxic to adult varroa and causes them to dislodge from honeybees. Varroa presence in a hive can then be checked by counting fallen mites in the bottom compartments, similarly to natural mite fall **(3.5.4)** and sticky mat **(3.5.5)** and will thus be used in conjunction with these two methods. Oxalic acid is also a natural compound used by bees and is not toxic to them at low enough concentrations, save low amounts of residues left in their wax and honey. Also, the acid is not strong enough to penetrate capped brood cells and kill juvenile mites feeding of larvae. Hence, this method will only be used during the winter period when honey production has seized, and no broods are present, but see below for further details.

Required equipment:

- 4,2 oxalic acid in sugar solution (50%)
- 50-60 ml syringe or special equipment for trinkling
- Protective clothing

Procedure:
Apply to all colonies within an apiary. Sprinkle oxalic acid on top of hive, between frames, directly onto bees. Task should be relatively easy during the wintering period as bees are gathered in clusters. Use in combination with natural mite fall **(3.5.4)** or sticky mat **(3.5.5)** to check for dead varroa dislodged from honeybees one week after application. Apply 4 ml / fully occupied space between frames, maximum 40 ml / colony with one wintering Langstroth box and maximum 50 ml / strong colony with two Langstroth boxes.
Sugar should be mixed to acid by at 35°C a few days before application using [**75 g oxalic acid + 1 kg sugar +1 L water**]. Apply trinkling when outside temperature ranges between 0-5° C and the bees are in strong winter clustering.
Timing:
If used frequently this method can be detrimental to bee health, hence it should only be applied once a month. Also, as the acid is not effective on mites in capped brood cells, it should only be applied during winter (Nov-Dec) when bees are overwintering, closely clustered together, with no capped brood cells and no honey production.
Report:
Identically to natural mite fall **(3.5.4)** or sticky mat **(3.5.5)**, note down number varroa found in the sentinel hives compartment (even if zero varroa are found). Observer should also note down number of varroa per colony/apiary per day, in order to help estimate spread and severity of possible future infestations. As daily varroa counts are the norm when using this method, the observer should note down the average number of mites during their weekly checks. For example, finding 10 mites should be noted down as (10/7 = 1,4 varroa per day). **Please note**: any varroa detected is cause for alarm, as Åland aims to become a varrao-free region.

4. Moving forward

Besides improving continued monitoring of varroa on Brändö, this program will help educate and spread awareness to both beekeepers and the public. Continued communication between all parties involved (local beekeeper association, government of Åland, FFA and the public) is extremely vital to ensure Brändö regains its status as a varroa-free region. Furthermore, additional plans will be put into motion to improve monitoring methods of varroa for the rest of Åland.