How do yellow-legged hornets harm beehives, and when is the greatest risk?

	Hornet activity	Honey bee activity	Beekeeper activity	Interactions	Risk to beehives
SPRING	Hornet queens emerge from their winter dormancy and begin foraging and building a small nest, called (embryo/incipient) primary nest. The primary nest is frequently located on man-made structures (if present). The founder queen raises the first brood all on her own. She does all the work, including hunting (sometimes scavenging) protein for the carnivorous larvae. After about 50 days of brood raising activities the first workers will emerge and take over the brood rearing, foraging duties, and nest construction (expanding the primary nest). The queen stays inside the nest and focuses on laying eggs (at higher rates).	Honey bee queens increase their egg laying as the brood nest expands. The honey bee colony grows in size and may get a natural impulse to swarm and make new colonies. Honey bee workers forage a lot more to feed the expanding colony with protein (from pollen) and carbohydrate (nectar). Drones start to appear in spring, or will increase in number in the hive, and mating may happen between drones and new queens.	Spring is a season of frequent hive inspections. It is often the beekeeper's first inspection of hives after winter, and they check hive survival and for diseases. Beekeeping then becomes focused on spring build-up, aiming to increase hive strength. This may include supplemental feeding of protein supplements or sugar syrup. Beekeepers may replace old queens, and they may split hives to increase hive numbers. Frequent hive inspections may be performed to check and manage swarming behaviour. Beekeepers may be called upon by the public to collect swarms. Beekeepers will actively administer varroa treatments, and may move hives in preparation for pollination and summer honey flow.	Queen hornets do not generally target beehives. Queen hornets will forage on a variety of other insects (and invertebrates), and also forage on nectar. Detection of hornet activity is mainly through the discovery of primary nests. Carbohydrate traps may work best at this time of year but by-catch is a concern and traps must be checked and cleared regularly.	Low risk to beehives as only queen hornets are around. However, very early hornet nests may have workers that start targeting beehives. 
SUMMER	The primary nest is often abandoned and the hornet colony moves to a new location where it builds a much larger nest, called a secondary nest. The secondary nest is frequently located high in the tree canopy (if present). The hornet worker population increases exponentially as egg-laying and brood raising happens more quickly, taking not much longer than 30 days from egg to worker. In late summer, the hornet colony begins to raise reproductives, males and spring/new queens (gynes). More and larger broods require more food and the protein needs of the colony further increase. Adult hornets are particularly energetic (being fed back by the larvae), bold, and likely to be aggressive. This is the period of most intense and diverse foraging. At its peak, the hornet colony can have more than 1000 adults.	Large amounts of nectar become available from flowering plants, and honey bees increase their foraging to take advantage of this. Honey bee colonies attain their maximum size, often exceeding 50,000 honey bees in a single colony. Drones are common and have matured. Queen matings are very successful at this time of year due to the presence of mature drones and favorable flying conditions. However, swarming impulses in colonies do reduce when floral nectar flows increase, as the colony turns its focus to storing honey in preparation for winter.	Beekeepers place honey boxes (supers) on hives. This is the season where beekeepers focus on getting honey. Honey may be harvested at any time, but especially late summer. Hive inspections become less frequent as bees are left to gather nectar and increase their honey stores. Swarming of bees becomes less of a risk. Beekeepers may move hives to take advantage of seasonal honey crops.	'Hawking' behaviour of hornets at beehive entrances becomes common. Beekeepers may need to observe beehive entrances for 10–20 minutes to be able to observe this behaviour. It will not be as obvious to beekeepers as the robbing that is done by bees or wasps. Hornets target honey bees on the wing, rather than going in the hive itself. This is the time of year of greatest risk to beehives. Hornet predation of beehives is at its peak but beekeepers are spending less time with their hives. Both protein and carbohydrate traps could work for trapping hornets, but by-catch will be an issue and traps must be checked routinely.	Very high risk to beehives as hornet workers emerge and target bees. Increasing 'bee hawking' by hornets. Beekeepers may not notice this due to reduced hive inspections in summer 
AUTUMN	Males and spring queens mostly leave the nest. Mating occurs, the founder queen dies, the hornet colony loses social cohesion and declines, and the nest contains decreasing hornet numbers.	Queen egg laying slows and the colony stops making drones. Drones may be turned away from the hive as the colony no longer needs them. Colony size is reduced as brood production is lowered, and the focus is on producing winter-ready bees. Autumn can be a dangerous time as varroa mite levels can get very high. It is difficult for beekeepers to administer varroa treatments during summer. Bees will rob honey from other colonies during this time. Wasps may also exert pressure on honey bee colonies at this time of year.	Honey harvest continues, and honey boxes (supers) are removed. This is a period of intense varroa mite treatment by beekeepers, to recover from summer and to prepare for winter. Beekeepers may requeen their hives, or perform splits of hives, taking advantage of the last opportunity for matings and settled weather. Beekeepers will check hives are strong and ready for winter.	Hornet males may be found far from the nest due to their search for queens to mate with. 'Hawking' behaviour of hornets targeting bees may continue into autumn. Hornet queens may hide in beekeeping equipment, readying themselves for hibernation in winter. Declining hornet nests may be discovered. Protein bait traps may be more likely to catch worker hornets due to brood rearing activities in the hornet nest requiring protein.	High risk to beehives in early autumn, when hornet nests still have high nutrional need for protein for reproductive brood rearing. Decreasing 'bee hawking' by hornets. Beehives may also be under pressure from varroa. 
WINTER	Males die off, and only the spring queens survive. The mated spring queens find hiding places to hibernate and survive the winter, waiting to start new nests in the following spring. In areas of New Zealand with a mild climate, hornet hibernation may be very short, or not occur at all.	Winter bees live much longer than in other seasons. The queen may cease laying, and a broodless period may occur. There is a heightened risk of colony death if high varroa levels were sustained during autumn. Starvation can be possible if honey stores are not adequately provisioned. Anything that has weakened the colony in autumn can cause colony loss in the winter.	Beekeepers have limited opportunity for hive inspections due to weather conditions. Varroa treatments may be administered, as it has become necessary to provide treatments year-round for colony survival. Warmer areas of New Zealand may not experience a broodless period and the varroa mite can continue to reproduce and cause damage.	Hornet queens may hide in beekeeping equipment during their hibernation in winter. Northern parts of New Zealand may not experience the full effect of a winter, and hornet activity could occur throughout the year.	Very low risk to beehives as no hornets are typically active. However, hornets may have weakened bee colonies in the autumn, and pressure from varroa. 