

Caribou Introductions – Wawa District Implications for Caribou Restoration in the Lake Superior Area

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In the 1980's the MNR Wawa District introduced caribou at 4 locations around northeast Lake Superior. Caribou have persisted at only 1 of these sites. It has often been interpreted that conditions at the other 3 areas are no longer suitable for caribou. However, there were problems associated with the introductions that could explain these failures. If these problems are corrected, these introductions could be successful if tried again. These lessons could also benefit other attempts to maintain and restore caribou in the Lake Superior area.

The Introductions

1. Michipicoten Island - 1982

Michipicoten Island is a large island of about 200 km² that lies about 65 km WSW of Wawa in Lake Superior. Caribou were present on Michipicoten Island until the late 1800's when they were probably shot off during a period of mining activity.

There were two main purposes of this introduction: 1) restore caribou to this part of their former range; and 2) test Tom Bergerud's hypothesis that it is predation and hunting - not habitat - that limit most caribou populations. Tom has assembled data that indicate that caribou do not do well at wolf densities near or above 6.5 per 1000 km² - which occurs when moose are around 10 per 100 km². He has also made the observation that caribou can exist at high densities in areas of poor habitat if predation is low - like the Slate Islands and parts of Newfoundland.

In the fall of 1982, 8 caribou were moved from the Slate Islands to Michipicoten Island - 1 bull, 4 cows, and 3 female calves. There was likely 1 other bull on the island that had presumably come across from the Pukaskwa area on the mainland. The tracks of this animal were seen by the lighthouse keeper in the summer of 1981. We observed a lone bull caribou near the southwest corner of the island during an aerial survey in early 1982 - no other caribou sign was seen.

This population grew steadily and is likely over 400 animals now - based on recent population estimates by Ben Kuchta at Lakehead University. The success is attributed to the absence of large predators on the island. There are no wolves or bears, and the largest predator is the fox. The island is about 15 km off the mainland and this part of the lake rarely freezes well. So wolves are unlikely to reach the island. We hear rumours of some hunting on the island, but it has not been enough to limit the population.

A large portion of the island is Great Lakes-St. Lawrence forest type - dominated by sugar maple. There is also typical conifer dominated boreal forest - particularly along the edge of the island. But the Great Lakes forest portion of the island is well used by caribou - as is the more typical boreal forest habitat. Ground surveys on the island in the spring of 2010 indicate that there are virtually no lichens left that are accessible to caribou.

The success of the Michipicoten Island introduction supports Tom Bergerud's contentions that caribou are not dependent on lichens or boreal forest - but are dependent on low predation and hunting.

The future of Michipicoten Island holds a variety of possibilities. If left alone, the caribou will exceed their carrying capacity and their population will decline and then fluctuate - like the Slates. The island would also be an ideal site to study the effects of predation - perhaps using neutered wolves or even a smaller predator like the threatened wolverine.

2. Montreal Island – 1984 & 1986

Montreal Island is a medium sized island of about 7 km² that lies about 5 km offshore in Lake Superior about half way along the east shore. Caribou seem to have existed along the east shore of Lake Superior until the early 1900's. The main reasons for their disappearance from this area were probably hunting and increased predation. Predators likely increased in response to the spread of moose following increased forest disturbance from fire and logging.

The purposes of this introduction were: 1) restore caribou to this part of their former range; and 2) test Tom Bergerud's hypothesis that caribou do well in the absence of predation and hunting. In particular, we wanted to determine if caribou could be established on predator-free islands that are smaller and closer to the shore than Michipicoten Island. A couple of results were foreseen: 1) the caribou would do well but eventually deplete their food and move to the mainland where they may or may not survive predation; or 2) wolves would find their way to the island in winter and eat or drive off the caribou.

In the fall of 1984, a total of 7 caribou were moved from the Slate Islands to Montreal Island - 1 bull, 3 cows, 2 male calves, and 1 female calf. One cow moved up to Leach Island, so the population started off with 6 animals. Another cow was also moved but escaped on the mainland, and another calf died during the transfer. In the fall of 1986, another 2 cows were added from the Slates. So a total of 8 caribou were moved and stayed.

This population grew steadily until 1994 and likely numbered in the 20's. The winter of 1994 was relatively long and cold and Lake Superior froze out to Montreal Island for a longer period than normal. A pack of wolves reached the island that winter and apparently killed all the caribou. We did not hear of any caribou escaping to the mainland.

The initial success on Montreal Island was attributed to the lack of caribou predators on the island. Again, fox is the largest predator. However, the eventual failure of the introduction was attributed to the fact that wolves were able to reach the island from the mainland. The island is 5 km offshore and Lake Superior freezes out to the island for a few weeks in most years. In addition, the island is flat and offers no rugged habitat where caribou might be able to escape wolves – like Pic Island. It appeared that Montreal Island was periodically accessible by wolves and did not provide good enough predator escape habitat.

However, a few years after the demise of the caribou on Montreal Island, I was talking with Shane McWilliams, the commercial fisherman who set nets under the ice near the island. He told me that the wolves would follow his snowmachine tracks to feed on the suckers that he left on the ice. So it could be that the wolves were attracted to the island by the commercial fishing and ended up finding the caribou.

Commercial fishing no longer occurs under the ice by Montreal Island. In addition, the period that the lake freezes out to the island seems to be getting shorter. So the chances of wolves getting out to the island should be much lower now than in 1994.

The failure of the Montreal Island introduction supports Tom Bergerud's thesis that caribou are limited by predation. However, another introduction there may very well be successful - if wolves are not attracted onto the ice and have less time to reach the island. In this case, caribou may increase to higher numbers, then move off the island to find food on the mainland – and hopefully establish a population there.

3. Leach Island - 1984 & 1986

Leach Island lies about 20 km NW of Montreal Island along the east shore of Lake Superior. The purposes of this introduction were the same as for Montreal Island. The two islands are very similar – Leach is about 5 km², flat, and about 5 km from shore.

One of the cows moved to Montreal Island was found on Leach Island in the winter of 1985. In 1986, we moved 3 caribou from the Slates Islands to Leach Island - a bull, a cow, and a female calf. The cow we moved was paralyzed when released and died later. Therefore the population started off with 3 animals.

The bull apparently impregnated the original cow twice and then left the island. The cow had female calves – resulting in a population of 4 cows on the island in 1987. The bull never came back and we were never able to get either the funding or the weather to move another bull there. Eventually the population dwindled to 1 and then disappeared in the mid 1990's. It appeared that the animals died naturally and that wolves did not reach the island.

The failure of the Leach Island introduction is clearly related to not moving enough males at the time of the initial introduction. But we also have some other information indicating that another introduction there may have a better chance than on Montreal Island. During the conversation I had with the commercial fisherman about Montreal Island we also talked about Leach Island. He said that Lake Superior hardly ever freezes well enough or long enough to get out there. He thought Leach Island would be a better candidate for caribou because wolves would be very unlikely to get out there.

So, another introduction to Leach Island may very well be successful - if we introduce enough animals of both sexes and wolves can't reach the island. In this case, caribou would be expected to increase to a high level, then move off the island to find food on the mainland – and hopefully establish a population there. We could also use Montreal and Leach Islands as close sources of animals to move to the mainland, and thereby reduce aircraft costs.

4. Gargantua – 1989

The Gargantua area is on the mainland along the east shore of Lake Superior. This is the part of Lake Superior Provincial Park that extends the farthest west out into Lake Superior and is about 45 km SSW of Wawa.

The purposes of this introduction were: 1) restore caribou to this part of their former range, and 2) test Tom Bergerud's hypothesis that caribou do well if predation and hunting are low. In particular, we wanted to determine if caribou could be established on the mainland - where they would be subject to predation by wolves and bears, but have some habitat features that help them escape from predators. The Gargantua area was selected because it has rugged terrain and small islands close to shore which caribou may be able to use to evade predators. This is similar to Pukaskwa National Park where a small population of natural caribou still persists. A couple of results were foreseen: 1) the caribou would persist in low numbers, as in Pukaskwa; or 2) wolves would find the caribou and eliminate them relatively quickly.

In the fall of 1989, a total of 39 caribou were moved from the Slate Islands to the Gargantua area – 10 bulls, 26 cows, 1 male calf, and 2 female calves. Some were released on Devils Warehouse Island, and some on the mainland in Gargantua Harbour. During the transfer, 1 of the bulls and 2 of the cows died. Initial mortality of the other animals that we moved was very high. We had about 17 animals radio-collared and lost most of these animals in the first winter. Most of the dead animals we were able to examine were intact – indicating that they were not killed by predators. We attributed the high mortality to the very poor shape the caribou were in when we moved them. Densities on the Slate Islands were at an all time high in 1989, and the population there collapsed in the winter of 1989-90.

Despite the heavy losses in the first year, some animals survived. The population persisted for two decades until about 2009, but was very low for the last few years.

The initial decline of the introduced caribou at Gargantua is attributed to their poor condition when moved. However, their subsequent persistence for two decades is attributed to the terrain around Gargantua which gave them some protection from predators. The caribou regularly used Devils Warehouse and Dixon Islands and had eliminated all accessible lichens on those islands. When seen in winter, the caribou were always associated with the islands or with strong relief – usually on the tops of steep hills. Their final disappearance is likely the simple result of long term mortality from predation being slightly higher than recruitment. In recent years, there may also have been breeding factors associated with the very small population. (Doing it with your children, your siblings, or your parents is not good.) There

may also have been some hunting mortality. Although not thought to be a major factor, hunting mortality would be largely additive and would contribute to population decline.

The eventual failure of the Gargantua introduction supports Tom Bergerud's thesis that caribou populations often succumb to predation when moose densities are greater than 10 moose per 100 km². The moose population in Lake Superior Provincial Park is about 40 moose per 100 km². However, the population persisted for two decades – which isn't bad for being in one of the highest moose density areas in Ontario. A few things about the Gargantua introduction indicate that another introduction to this area might be successful:

First, establishing a few small populations (8-12 animals each) along the east shore of Lake Superior and along the north shore to Pukaskwa National Park may be better than a large introduction in one place. Spreading the caribou out may make them harder for wolves to eliminate. Movement among these populations could build up populations that are in decline or even reestablish populations that go extinct. This metapopulation approach would also help maintain genetic diversity and improve genetic exchange. Perhaps this distribution of caribou would have occurred after the 1989 intro if the initial mortality had not been so high.

Second, the area may be getting more favourable for caribou. The amount of young forest in Lake Superior Provincial Park is getting smaller. Logging was halted in the Park in the mid 1980's, and many of the cuts are no longer in the preferred stage for moose. If moose densities decline, then predator numbers may also decline. In addition, the habitat may also become better for predator avoidance if winters become milder and ice freezes to the offshore islands for a shorter period. At present, ice regularly forms out to Devils Warehouse and Dixon Islands in late winter, and those refuges become accessible to wolves.

Over the last few years, I suggested introducing a few more caribou at Gargantua. The idea was to augment the population with new breeding stock before it went extinct. This would take advantage of the animals that were already there. The caribou translocated from predator-free islands might be able to learn behaviours from the existing animals that would help them evade predators. The remaining caribou may also have undergone genetic selection that made them more suited to their environment. These genetic characteristics may help make a supplementary introduction more successful. I also wanted to introduce a chain of small populations along Lake Superior from Lake Superior Provincial Park to Pukaskwa National Park to make a more viable metapopulation.

Unfortunately these ideas were not approved before the demise of the Gargantua population. There were two main reasons for them not being approved:

- 1) Managers wanted to wait for caribou recovery plans to be completed and approved before approving restoration projects like this. In addition, the Lake Superior area was assigned a low priority for caribou recovery, so the planning process has been extremely slow and is still not completed.
- 2) Some biologists involved in caribou restoration do not think it is appropriate to manage for caribou in areas where they have already disappeared or where we might have to periodically replenish populations because mortality generally exceeds recruitment. They want to address the root causes for mortality exceeding recruitment.

However, it is important to recognize the realities of managing a threatened species like caribou. Populations have disappeared or decreased because factors in their environment have changed enough to cause mortality to exceed recruitment. Unfortunately, we are often unable to adjust these factors so that recruitment becomes neutral or positive. Yet, in many of these places the conditions for caribou are still mostly suitable, and they may become completely suitable again. For example, caribou could increase if forest aging or hunting can reduce moose numbers and therefore wolf predation. As part of a recovery strategy, it seems reasonable to keep caribou in these mostly suitable areas until conditions change. But the only way to maintain existing populations or replace lost populations in such areas is to move caribou to them. Net productivity and immigration are too low to do the job at present. In these cases, introductions can be looked at as temporary artificial immigration.

Other Introductions Around Lake Superior

Caribou Island - Caribou Island is another medium sized flat island of about 4 km² that lies in Lake Superior near the international boundary. It is about 100 km SW of Wawa and about 35 km south of Michipicoten Island. Caribou were reported there in the 1700's but had disappeared by the 1930's when caribou from Newfoundland were moved there. These animals apparently disappeared in the 1950's. Because of the size of the island, the caribou would exceed their carrying capacity quickly and either die off or leave. In years past, caribou could leave or recolonize the island on the ice. Caribou range also surrounded Lake Superior, so it would be possible for bands of caribou to periodically reach the island on the ice. Ice cover on Lake Superior is now rarely extensive enough to connect Caribou Island to the mainland, and Michipicoten Island is now the only place that could supply immigrants to the island. Therefore, to continue to have caribou on Caribou Island would require us to be the agent of immigration and periodically move some there. Natural recolonization of the island over the ice from Michipicoten Island is not likely.

St. Ignace Island - St. Ignace Island is a large island along the north side of Lake Superior off the Nipigon River – it has both moose and wolves. In October 1985, 5 radio-collared cows and 1 uncollared bull were moved there from the Slate Islands. The animals were actually released on Bowman Island - a small island of about 2 km², off the south side of St. Ignace. The animals did move to St. Ignace. But during their first winter they moved to successive ice free islands off the south side of St. Ignace. They disappeared after ice formed out to the last island. This movement seemed to be predator avoidance behaviour in response to the wolves on St. Ignace. One animal moved to the Black Bay Peninsula, another animal was thought to have died on the ice in Black Bay and its radio-collar was underwater, and the other 4 animals were never heard from. Wolves were likely the main reason for the failure of this introduction. The caribou may even have been more susceptible to predation by being confined to an island with wolves. That is, caribou on the mainland may actually have more space to evade wolves. The animals were also stressed during the transfer – they were moved by tug and the journey was long and very rough. However, they did survive the move and did not disappear until late winter.

Terrace Bay Mainland - In October 1984, 2 radio-collared bulls and 1 radio-collared cow were moved from the Slate Islands to Cape Victoria, just east of Terrace Bay. The purpose of this move was to get radio-collared animals to hook up with caribou on the mainland so that the mainland caribou could be located and their movements followed. This worked to some extent. The cow initially stayed on Cape Victoria where other caribou were located. Later it moved to Mt Gwynne south of Schreiber where it was located with other caribou and where it may have had a calf. One of the bulls was located and seen with 5 other caribou on the mainland opposite Pic Island in winter 1985. It was seen again in Aug 1986 near the mouth of the White River in Pukaskwa National Park. The other bull was located in the Jackfish area where there were other caribou - including ear tagged animals from the Slates that had presumably come across on the ice in the winter of 1985. This bull was then found dead and washed up on a Lake Superior beach in the winter of 1985 – it did not appear to have been predated. The other two animals were detected for about a year after they were moved - until their collars died. This shows that caribou from predator-free islands will hook up with local mainland animals and can survive.

Natural Movements of Caribou Around Lake Superior

Otter Island and Pic Island - Caribou move readily from Otter Island and Pic Island to the mainland and back. But these islands are quite close to shore – about 0.5 km.

Slate Islands - Caribou tagged on the Slate Islands have been observed on the mainland around Terrace Bay in the 1980's. The Slates are about 9 km offshore. This indicates that caribou from Leach or Montreal Islands could move to the mainland and establish small populations there.

Summary of Introductions

Michipicoten Island - Caribou do well in areas with no predators – even in habitats that are not boreal forest and where lichens have been depleted. Caribou will eventually become food limited here, and the population will fluctuate, as on the Slate Islands. However, there is also the potential to introduce predators to Michipicoten Island to avoid food limitation and study the effects of predation.

Montreal and Leach Islands - Caribou may also do well on smaller predator-free islands closer to the shore. But the test of this has not been properly done yet. There is a good chance of success on Leach and Montreal Islands if introductions are made to these areas again. Enough animals of each sex need to be moved. And there now appears to be less chance for wolves to get to these islands. Caribou from these introductions could eventually move or be moved to the mainland and create small populations there.

Gargantua - There is potential for caribou to persist on the mainland around Lake Superior in areas with good habitat to escape predators – such as offshore islands and rugged terrain. Caribou could be reestablished again at Gargantua, and may do better. Animals moved should be in better condition than in 1989. The habitat in Lake Superior Provincial Park may be getting less suitable for moose and therefore wolves. In addition, milder winters may keep the small offshore islands as refuges for longer periods. The most promising approach is to create a chain of small populations along the Lake Superior shore. Movement of caribou among these bands could then build up groups that are in decline or even reestablish ones that go extinct. It may still be necessary to periodically augment these groups. This should be done before a group disappears - introduced animals may learn predator avoidance from the remaining caribou, and beneficial genetic selection in the group can be perpetuated.

Caribou Island - This island could have been colonized by caribou periodically in the past when Lake Superior regularly froze completely. But ice conditions have changed and it would require an introduction to establish caribou there again.

St. Ignace Island - The introduction here failed almost certainly because of predation. Being confined to the island with wolves may have contributed to their demise. The transfer by tug was long and rough, and not recommended - although the caribou all survived the transfer.

Terrace Bay Mainland - Introductions of radio-collared caribou to the mainland indicate that they will hook up with native animals and are able to evade predation.

Natural Movements from Islands to the Mainland - Some tagged caribou have moved the 9 km from the Slate Islands to the mainland. This indicates that caribou could move from other introduced island populations to the mainland and perhaps establish populations there.

Implications for Caribou Restoration Around Lake Superior

Potential For Introductions - Analysis of our previous introductions indicates that Leach and Montreal Islands should be tried again. Caribou could then move or be moved from these islands to the mainland. On the mainland, Gargantua should be tried again. And a chain of small introductions should occur along the shore to create a resilient metapopulation. This would give the best chance of success of establishing caribou on the mainland.

Mainland Introduction Sites - Picking sites similar to the habitat used by the existing caribou in Pukaskwa National Park offers the best chance for success. The key characteristics seem to be good predator escape habitat in the form of offshore islands and rugged terrain on the mainland. Rocky, low productivity sites may also be advantageous in terms of not attracting moose and therefore wolves. This approach worked at Gargantua for two decades. Along the east shore the best candidates would be Gargantua, then Brule Harbour and the Agawa Pictographs. On the north shore between Wawa and Pukaskwa National Park, the best candidates would be Ghost River and Floating Heart Bay to Crane Island - areas caribou are known to have used in the 1980's. Further east, the best locations would be Mountain Ash Hill where caribou were seen in the 1970's, and Dore Point to Makwa River.

Placing Animals - When moving animals to augment an existing population, the new animals should be placed as close as possible to existing ones. The introduced caribou are likely to come from the Slate or Michipicoten Islands, so they will be unfamiliar with predators. Putting them near existing animals gives them the best chance to hook up with their bush-smart cousins, avoid predation, and increase their survival. The caribou moved to the mainland near Terrace Bay indicate that this is feasible. If there are no existing animals, then pick the best predator escape habitat for release – like offshore islands or areas of rugged terrain.

Minimum Introduction Numbers - The Leach Island introduction indicates the need to have back-up animals in any transfer. Moving 2 bulls and 4 cows is a good minimum for islands where caribou are confined or to augment an existing population. But 3 bulls and 6 cows or 4 and 8 would be a better minimum for mainland introductions where animals could disperse or be subject to immediate predation. This is also similar to natural band sizes in the south end of caribou range.

When to Augment a Population - Don't wait for the original animals to disappear, take advantage of their experience and genetics. If we want to introduce caribou again to the mainland in Lake Superior Provincial Park, the new animals will have to develop their own predator avoidance techniques – they will not be able to learn from the animals in the population that survived there for two decades. And the new population will not be able to incorporate any beneficial genetic selection from the original population. This is particularly relevant to Pukaskwa National Park's project to augment their dwindling caribou population.

Movement Techniques

Method of Transfer - The St. Ignace Island caribou were stressed by a long boat trip, which suggests that animals should be moved as quickly as possible. Animals should be moved and released the same day they are caught to minimize the period they are under stress. The Wawa introductions had good success with float planes and final release by small boats. But helicopters should also be considered to move animals out to release locations because they are quicker and are not dependent on calm lake conditions.

Method of Handling - The physical methods for handling caribou are well established – blindfolds, ear plugs, padded leg restraints, transport on sternum, cool conditions, etc. However the use of drugs is not as straight forward. We lost some caribou to capture stress – some of which might have been related to the drug that was used during transfer – acepromazine. My inclination would be to avoid drugs and just move the animals quickly.

Adverse Conditioning to Avoid Predators - Caribou that are moved have plenty of adverse conditioning to humans, but none to other predators. It might be worth trying some adverse conditioning to dogs when the caribou are released. I know a Welsh terrier that would enjoy doing this, but a larger dog that looks more like a wolf may be better.

Assessment

Radio-collars - Of the caribou moved to Gargantua, we had almost total mortality of the 17 radio-collared animals in the first year. It is not clear what role the collars played in this high mortality, but the animals were in poor condition and the collar might have been the proverbial last straw. We were lucky we didn't have the money to collar all the animals. For establishing new populations or augmenting small populations, it may not be necessary to radio-collar the animals - success or failure can be determined with a simple aerial survey. However, biologists are often fixated on knowing everything about the animals they move, so a suggestion to avoid radio-collaring is not likely to go very far. Therefore, use the smallest possible radio-collar. The collars used now are much larger and heavier than the ones used 30 years ago – instead of miniaturization we've opted for more features. Do you need all those features? Here is a practical way to determine if the collar is a reasonable size - caribou and biologists are about the same size, so just wear one around for a few days.

Conclusion

The above information can be incorporated in an adaptive management cycle for caribou restoration in the Lake Superior area. We started with the two objectives of trying to restore caribou and examining the effects of predation vs. habitat on caribou. The introductions were only partially successful in the former, but gave us quite a bit of information on the latter. We should now continue with our restoration objective using the knowledge we have gained.

There remains good potential to restore caribou in places along the east shore of Lake Superior south of Wawa. There is a very high probability of establishing populations on Leach and Montreal Islands. And there is a good possibility of maintaining some caribou on the mainland – especially if we use the metapopulation approach and get some immigration from Leach and Montreal Islands. But we should also be prepared to periodically augment the mainland populations if they get low.

However, the immediate priority should be to help rebuild the caribou population in Pukaskwa National Park. This is the southernmost mainland population of caribou or reindeer in the world, and they deserve to be maintained. Caribou have persisted here longer than anywhere else in the eastern Lake Superior area. So the ecological conditions for caribou are likely the best in this area, and therefore the potential for caribou recovery is likely the highest. ***The time to act is now*** – there may only be 4 caribou left in the Park. The Park is currently working on introducing caribou to augment these remaining animals. We should assist this effort however we can. We should also introduce a series of small populations of caribou between the Park and Wawa. These animals would link to the Pukaskwa population and restore a more resilient metapopulation along this part of the Lake Superior shore.

In the short term, caribou introductions are the only way to reverse the caribou population decline in Pukaskwa National Park and roll back caribou range recession in the Lake Superior area. But, for these introductions to be successful in the long term, it will also be necessary to reduce what is likely the main source of mortality on caribou - predation. To accomplish this, we will need to manage for the habitat and predator-prey population levels found in natural caribou ecosystems. Around Lake Superior, this implies low rates of forest disturbance - which should result in low populations of moose, beaver, bears, and wolves. But habitat change takes a long time and may not be possible in nearby areas with logging. So, it may also be necessary to use hunting to try to keep moose populations, and therefore wolves, at the low natural levels compatible with caribou.

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