Morel Mushroom Workshops and Harvests in the Northwest Territories in 2015

Prepared by: Joachim Obst

Arctic Ecology and Development Consulting,
Yellowknife NT (obst100@gmail.com)

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NWT Association of Communities

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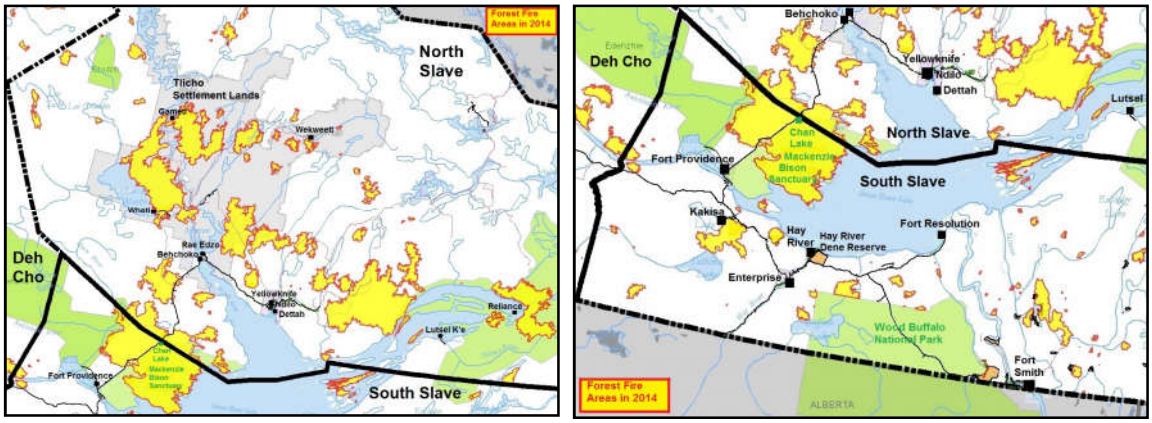
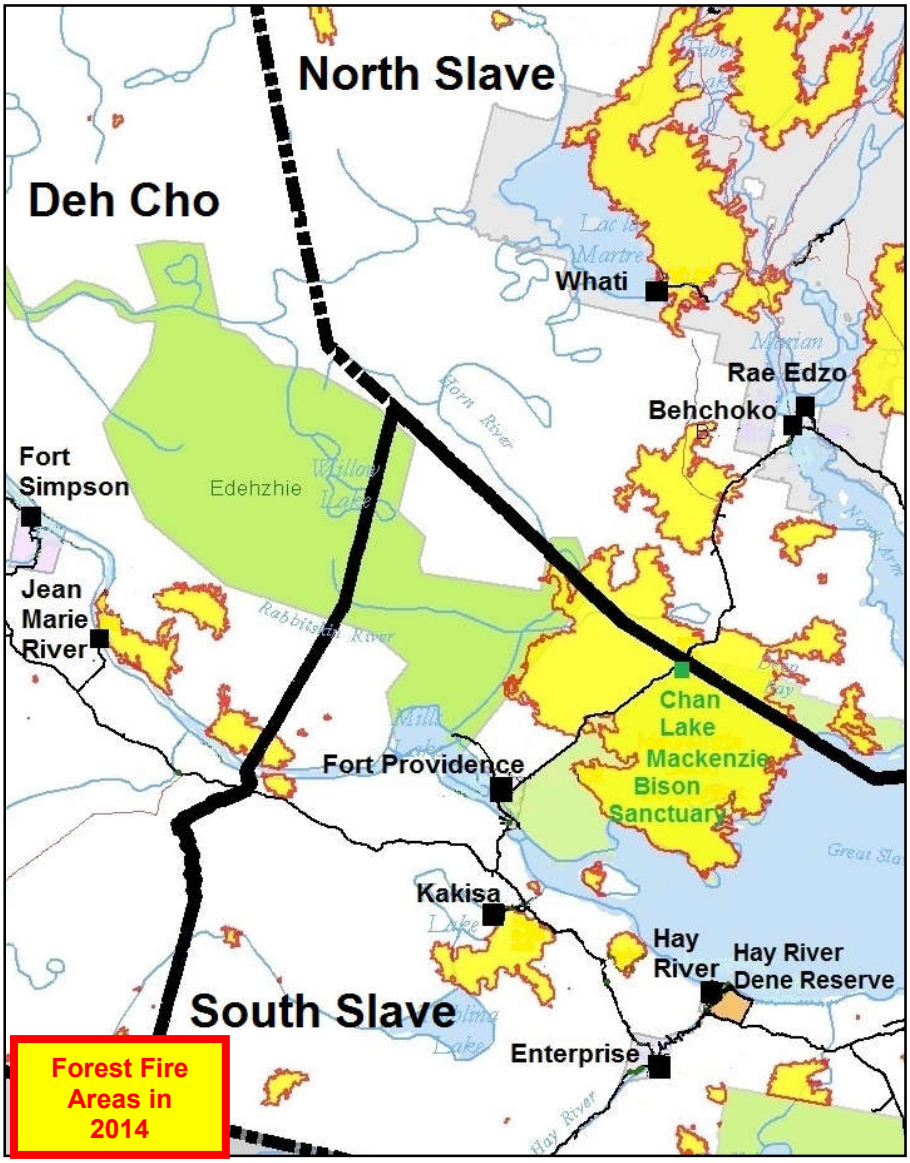


Maps 1 and 2. Overview of 2014-NWT wildfires and 2015-Morel harvest areas.



Map 3. Main areas of the 2015-Morel harvests in burned NWT forests.

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EXECUTIVE SUMMARY

The 2015-morel mushroom workshops in the South Slave, Dehcho, Tlicho and North Slave regions of the Northwest Territories (NWT) were hosted by the Department of Industry, Tourism and Investment (ITI), Government of the Northwest Territories (GNWT). From mid May to mid July, instructors W. Brown and J. Obst offered public walking field workshops in forest fire sites around Kakisa, Fort Providence, Behchoko, Whati and Lutsel K'e. A total of 1,700 northern residents and 300 visitors attended the workshops.

The main NWT morel harvests were on Highway #3 between Fort Providence and Behchoko from late May to early July and up to mid August. Onsite were three mushroom buyers from British Columbia, two NWT buyers, 30 - 35 northern entrepreneurs, and 500 - 600 people harvesting morels daily. Buyers onsite paid from $6 to $7/lb. (500 grams) of fresh morels to harvesters which was 50% lower than last year's price. The total cash paid out by all buyers and entrepreneurs to harvesters was an estimated $1.4 million of which northern harvesters pocketed $1.1 million and southern harvesters $300,000. Spin-offs for NWT businesses were estimated at $500,000. The harvest generated a cash flow of $1.9 million of which $1.7 million stayed in the NWT.

Most harvesters picked from 15 - 40 lbs. of fresh morels per day and earned from $90 - $280/day. Experienced harvesters earned up to $350 and $490/day occasionally. The estimated income for about 100 - 110 northern and 50 - 60 southern harvesters ranged from $4,750 to $7,500/person for 25 to 30 work days. Another 40 - 50 northern harvesters earned on average $10,500/person during the period from May 29 to July 22.

The total commercial harvest by all buyers and northern entrepreneurs on Highway #3 was estimated at 35,000 lbs. (or 17.5 tons) of dried morels (equals nearly 300,000 lbs. of fresh morels) representing a mean market value of $13 million. The combined commercial, private and recreational harvest was estimated at 40,000 lbs. (or 20 tons) of dried morels with a mean value of $15 million. Half of the dried morels are owned by NWT buyers, entrepreneurs and residents while the other half was bought by British Columbia buyers and provided instant cash for harvesters and the local economy.

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Photo credit: Joachim Obst

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1.0. INTRODUCTION

Morel mushroom workshops in 2015 built on the successful model of workshops and harvest from the year before in the Dehcho Region, Northwest Territories (NWT). The Department of Industry, Tourism and Investment (ITI), Division of Traditional Economy, Agriculture and Fisheries, Government of the Northwest Territories (GNWT) workshops were hosted in advance of the 2015-harvest to ensure residents would be able to participate and benefit from the anticipated harvest. Educational campaigns were implemented on morel harvesting. In 2015, they included community consultations, public presentations and walking field workshops near or at 16 communities affected by forest fires in the South Slave, Dehcho, Tlicho and North Slave regions of the NWT. "A Harvester's Guide: Morel Mushrooms in the Northwest Territories" was published with three condensed field versions for distribution in the South Slave, Dehcho, Tlicho and North Slave regions of the NWT. The publications were and remain available for free download from the ITI (GNWT) website.

2.0. COMMUNITY CONSULTATIONS

From early February to late April 2015, ITI hosted 19 public presentations and consultations in 16 communities of the South Slave, Dehcho, Tlicho and North Slave regions of the NWT. The presentations provided guidelines on how to harvest, handle and sell prized morel mushrooms growing in NWT forest fire sites and how to use this opportunity to earn a seasonal income or to set up a small business enterprise. More than 1,300 residents attended the presentations by mushroom experts Walter Brown and Joachim Obst from Yellowknife, and Bruce Green from Hay River, with the assistance of ITI staff from Yellowknife and Hay River, and in partnership with the NWT Community Association, Yellowknife.

3.0. WALKING FIELD WORKSHOPS

In March and April of 2015, NWT communities were informed about the locations and approximate schedules of the walking field workshops. The final dates were announced a week ahead of time when morels were large enough for harvesting

and education onsite. The schedules and locations for the workshops were posted on the ITI (GNWT) website, social media, and northern media was informed. Two signs were placed at the entrance of off-roads beside highways to guide visitors to the workshop sites in suitable areas for parking cars.

From May 25 - July 05, instructors Walter Brown and Joachim Obst camped in forest fire sites and offered daily morel mushroom field workshops from 10:00 am to 7:00 pm and on demand from 7:00 am to after midnight for early or late visitors. The duration of workshops usually ranged from 1 - 2 hours and group sizes ranged from 2 - 10 people, but occasionally there were up to 25 attendees and one time about 80. Daily total numbers ranged from 30 - 45 participants and up to 80 - 120 on several occasions. The workshop locations included the Kakisa area (for residents in the South Slave and Dehcho regions); 30 km south of Behchoko (for residents in the Tlicho and North Slave regions); Whati and Lutsel K'e.

A total of approximately 2,000 visitors attended the field workshops including about 1,700 northern residents and 300 southern harvesters and visitors. Most northern attendees were from the South Slave and North Slave regions with some from every other region of the NWT as well as Nunavut and Yukon. The northern attendees and harvesters included aboriginal and non-aboriginal people from nearly all cultural backgrounds present in the North including immigrants from other countries. The southern harvesters came from all provinces of Canada but especially from British Columbia (BC), Quebec and Alberta. In addition, more than 100 visitors/harvesters, mostly from European countries but with some from Asia, Africa, South and Central America, Mexico and the USA, also attended the workshops (Photos 1 to 24).

4.0. HARVEST AREAS

In 2014, wildfires burned 3.4 million hectare of boreal forest in the NWT representing the largest forest fire areas ever in Canada. The vast majority of burned areas were in the southwestern NWT and many were accessible by roads and from nearby communities. In 2015, the main morel mushroom harvests areas were in the 2014-forest fire sites between Fort Providence and Behchoko. Small scale harvests occurred in other burns of the Tlicho, North Slave, Dehcho and South Slave regions (Maps 1 to 3).

Plate 1. Kakisa Workshop.

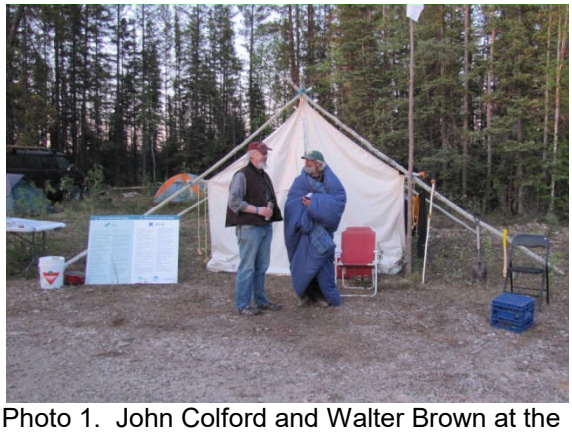

Photo 1. John Colford and Walter Brown at the morel workshop near Kakisa on a cold morning.

Photo 2. Kakisa morel workshop, May 11/15.

Photo 3. Kakisa workshop, mid May 2015.

Photo 4. Kakisa workshop, mid May 2015.

Photo 5. Morel instructor Walter Brown (right).

Photo 6. Morel instructor Bruce Green (right).

Plate 2. Kakisa Workshop.

Photo 7. Kakisa workshop, May 25, 2015.

Photo 8. Kakisa workshop, May 26, 2015.

Photo 9. Kakisa workshop, May 26, 2015.

Photo 10. Kakisa workshop, May 31, 2015.

Photo 11. Kakisa workshop, May 31, 2015.

Photo 12. Kakisa Chief Lloyd Chicot (center).

Plate 3. Behchoko Workshop.

Photo 13. Behchoko workshop, June 10, 2015.

Photo 14. Behchoko workshop, June 10, 2015.

Photo 15. Local harvesters stop by for coffee.

Photo 16. Behchoko workshop, June 10, 2015.

Photo 17. Behchoko workshop, June 12, 2015.

Photo 18. Harvester asks for directions.

Plate 4. Whati Workshop.

Photo 19. Workshops in Whati, June 19, 2015.

Photo 20. Workshops in Whati, June 19, 2015.

Photo 21. Workshops in Whati, June 19, 2015.

Photo 22. Workshops in Whati, June 19, 2015.

Photo 23. Workshops in Whati, June 20, 2015.

Photo 24. Workshops in Whati, June 22, 2015.

5.0. MONITORING OF THE HARVEST

Morel workshops served as communication centers for harvesters and entrepreneurs where they were interviewed daily by the workshop instructors. In addition, the instructors monitored the morel growing season and harvest for 73 days from May 11 - July 22, including 39 road survey days between Kakisa, Fort Providence and Behchoko. Recorded were the daily and total harvest intakes by harvesters and roadside buyers, harvest activities, numbers of harvesters, camps, tents, cars and license plates. About 2,000 pictures and film clips were taken to document the harvest. The estimated numbers of harvesters and workshop attendees were rounded up to the nearest 10 - 50 when exceeding hundreds of harvesters or visitors. The amounts of harvested fresh and dried morels were obtained from buyers and rounded up to the nearest 100 lbs. when exceeding more than 1,000 lbs. The statements of buyers were verified by witnessing the amounts of morels delivered by harvesters during 39 survey days and by interviewing harvesters about their harvested crop and income throughout the harvest. Mean drying ratios of 8.5 : 1 to 7.5 : 1 from wet to dry morels were used to recalculate fresh weights of morels when amounts of dried morels were provided by buyers. The estimated total amount of cash payout was based on the prices paid by buyers.

In addition to monitoring the main harvest area between Fort Providence and Behchoko, the harvest at Whati and three burns in the Great Slave Lake area were monitored for five days each. For the period from July 23 - mid September, additional data and information on the morel growing season and harvest in all four aforementioned regions were collected through interviews with several dozen of local harvesters, entrepreneurs, buyers and government authorities.

6.0. MOREL MUSHROOMS

6.1. Morel Growing Season and Harvest Period

The imminent beginning of the morel mushroom growing season in 2015 was indicated by a tiny mushroom, the fire cup (*Geopyxis carbonaria*), which grew in forest fire burns a few days earlier than morels. Indicators included the leaves on aspen (*Populus tremuloides*), balsam poplar (*Populus balsamifera*) and paper birch (*Betula papyrifera*). The first baby morels appeared on May 15 near Jean Marie River and on May 18 around Kakisa when the young leaves on these trees were three quarters fully grown. On May 22, the first young half-grown morels

were harvested near Kakisa and north of Fort Providence when these leaves were fully grown. Young morels and the first 30 lbs. of mature full-grown morels were harvested on May 24 near Fort Simpson in old 2013-burns and on May 25 around Kakisa and north of Fort Providence in 2014-burns. At the same time, Saskatoon berry (*Amelanchier aluifolia*) bushes were in full bloom beside highways in the Dehcho Region (Photos 25 to 30). The growing season was slowed down by a sudden cold spell for three days with freezing temperatures at night on top of dry soil conditions and the absence of rain in the Kakisa area causing young morels drying out. By June 03, it was obvious that the anticipated commercial morel crop was non-existent around Kakisa despite a promising early begin of the morel growing season.

In contrast, sufficient rain poured down during late May in the burns between Fort Providence and Behchoko. From May 25 - July 22, morels grew prolific and the season was marked by continuous flushes of rapid growth of morels which occurred every week. Some areas, particularly the burn just south of Behchoko, were systematically harvested and flagged by professionals and locals over and over again nearly every week. The peak growing season began slowing down by late July. In prime habitats, however, very large blonde and grey morels grew until mid August and harvesting was excellent although spotty (Photos 36, 37 and 40). Few morels grew until the end of August when the growing season reached the end between Fort Providence and Behchoko. The last known fresh and mature morel was reported and harvested south of Behchoko on September 05, 2015 (R.G. Bromley pers. comm.). Residents in Whati harvested morels from mid June to mid August. Morels also were reported around Gameti. Few morels grew in the East Arm area of Great Slave Lake in early July but morels were harvested on Simpson Island and around Francois Bay. Morels were harvested from early June to mid August in the South Slave Region.

The entire known morel growing season in all four aforementioned regions was 114 days from May 15 to September 05. The peak growing season was about 71 days from May 22 to July 31, followed by a moderate growing season for 15 days until mid August, and a sporadic scattered growth of morels for another 20 days until September 05. The peak harvests for most commercial harvesters was 34 days from May 29 to July 01. However, several dozen of local commercial harvesters picked morels for 58 days from May 29 to July 25 and some for 86 days from May 22 to August 15. The morel growing season in 2015 began three days earlier and the harvest five days earlier than last year in the Dehcho Region. This fell well within the predicted time frames by ITI and the morel workshop instructors.

Plate 5. Indicator Species of the beginning of the Morel Growing Season.

Photo 25. Fire cup mushroom, May 13, 2015.

Photo 26. Balsam poplar leaves, May 18, 2015.

Photo 27. Paper birch leaves, May 22, 2015.

Photo 28. Saskatoon berry, May 24, 2015.

Photo 29. Baby morels, May 15, 2015.

Photo 30. Young morels, May 18, 2015.

6.2. Morel Species and Habitat

At least five species of edible true morels grew in all four regions including *Morchella conica*, *M. elata*, *M. angusticeps*, *M. esculenta* and *M. atrotomentosa*. These species are known informally as conica, black, natural, blonde and grey morels, respectively. Each species produced variations in colours and shapes including: brown, grey, black, creamy, tan, blonde, bright yellow, pink, and greenish-grey later in the season. White morels grew around Whati in the same areas as all other colourations and species of morels (Photos 31 to 42).

Prime morel habitat occurred exclusively in burned jack pine (*Pinus banksiana*) forests and around individual jack pine trees or stands in mixed forests. The best habitats were older stands of burned or partially burned pine but morels also grew in younger stands of pine. The most productive sites were within or near the edge of the "pine needle zone" and particularly in venues or depressions where the edge of the pine needle zone bordered a "green band" with partially burned or unburned trees and some fresh vegetation growth (Photos 43 to 45). Burned pine trees occurred in well-drained areas while the bordering "green bands" were moderately drained. This prime habitat was easily recognized even from far distances by experienced harvesters. These areas also provided easy walking terrain. Marginal habitats with few morels included burned white spruce (*Picea glauca*) in well-drained areas. Poor habitats consisted of burned black spruce (*Picea mariana*) and larch also called tamarack (*Larix decidua*) in poorly drained areas and wetlands where morels were nearly absent. Walking in poor morel habitats was difficult.

Plate 6. Morel Mushroom Species.

Photo 31. Conica Morels.

Photo 32. Conica Morels.

Photo 33. Black Morel.

Photo 34. Natural Morels lit by sunset.

Photo 35. Natural Morels.

Photo 36. Blonde Morels.

Plate 7. Morel Mushroom Species.

Photo 37. Blonde Morels grew big in mid July.

Photo 38. Tan-coloured variety of Morel.

Photo 39. Grey-whitish variety of Morel.

Photo 40. Blonde and Grey Morels.

Photo 41. White Morels in Whati.

Photo 42. Conica, Grey and White Morels.

Plate 8. Morel Prime Habitat.

Photo 43. Prime morel habitat at the edge of burned jack pines bordering green areas and aspen. Morels grew plentiful within or near the edge of the red-brown carpet of pine needles.

Photos 44 and 45. Prime morel habitat within or at the edge of the red-brown "pine needle zone".

7.0. MUSHROOM BUYERS AND HARVESTERS

7.1. Mushroom Buyers and Entrepreneurs

During the period from May 11 - June 03, two mushroom buyers from British Columbia working together as a team and an NWT buyer from Yellowknife set up their morel mushroom buying and drying stations for 2 - 3 weeks beside Highway #1 near Kakisa. However, the commercial morel harvest in the Kakisa area was poor and all three buyers moved by late May/early June. The two BC buyers set up their new buying and drying station beside the gas station near Fort Providence. The NWT buyer set up in the burns along Highway #3 at first north of Fort Providence and later south of Behchoko. A fourth buyer from Fort Providence operated a community-based buying and drying station. A fifth buyer from BC set up in the burn south of Behchoko in mid June. A sixth buyer from BC checked out all burns before the beginning of the morel growing season but decided to return to burns in BC. Originally, about a dozen of mushroom buyers from BC expressed a desire to come to the NWT but most ended up staying in productive burns in BC. In addition, an estimated 30 - 35 northern entrepreneurs, including local aboriginal and non-aboriginal families, operated private drying stations in the burns between Fort Providence and Behchoko. Some local entrepreneurs also were reported in other burns (Table 1; Photos 46 to 51).

Plate 9. Morel Mushroom Buying Stations near Kakisa.

Photo 46. BC mushroom buyer near Kakisa.

Photo 47. BC mushroom buyer, May 25, 2015.

Photo 48. BC mushroom buyer's drying station.

Photo 49. BC mushroom buyer's buying station.

Photo 50. A second BC mushroom buyer.

Photo 51. A Yellowknife buyer is setting up.

7.2. Harvesters

7.2.1. Harvesters near Kakisa, Fort Providence and Behchoko

In the Kakisa area, the first 50 - 60 southern harvesters arrived between May 10 - 15. After mid May, 26 tent camps and camping sites with approximately 200 harvesters, including about half and half southern and northern harvesters, were located beside Highway #1 until the end of May and the beginning of June. By June 04, everybody had left the Kakisa area because the morel crop was poor for commercial use. About half of the estimated 100 young southern and foreign novice pickers went to burns in BC instead while the remaining southern and all northern harvesters went to the big burns north of Fort Providence and joined hundreds of harvesters already there (Table 1).

From June 04 - 17, up to 57 camp sites with an estimated 500 harvesters were counted along Highway #3 between Fort Providence and Behchoko. More camps and morel drying stations operated by northern entrepreneurs and local families were out of sight deep in the burned areas (Photos 52 to 63). The vast majority of the estimated 500 - 600 people harvesting morels nearly daily were NWT residents, including about 300 northern and 200 southern fulltime harvesters and up to 50 - 100 local recreational harvesters coming and going on a daily basis (Table 1). After June 17, an estimated 100 - 125 novice southern and foreign pickers left the NWT and 40 - 50 northern harvesters also went home. About 150 northern and 50 - 60 southern fulltime harvesters continued selling morels to buyers until July 01. By July 04, only two northern buyers, a southern buyer, a few dozen northern harvesters and several southern harvesters continued harvesting until mid July. On July 21, only a few northern and southern harvesters, an NWT buyer and a BC buyer were still on site south of Behchoko. By July 31, the main harvest was basically over but some northern commercial harvesters and entrepreneurs continued harvesting until mid August. In addition to commercial harvesters, an estimated total of about 2,000 northern recreational harvesters picked morels mostly for private use at least once or occasionally for an afternoon or a few days along Highway #3 during the period from May 22 to mid August. Tourists travelling by car or arriving with scheduled bus tours from Yellowknife also harvested morels.

Plate 10. Morel Harvester's Camps beside Highway #3.

Photo 52. A Behchoko family's morel camp.

Photo 53. Local harvesters' morel camp.

Photo 54. Local harvester's morel camp.

Photo 55. About 50 local harvesters camp here.

Photo 56. NWT harvesters' camp; Highway #3.

Photo 57. Harvesters' camp; Highway #3.

Plate 11. Morel Harvester's Camps beside Highway #3.

Photo 58. Local harvesters' camp; Hwy.#3.

Photo 59. Harvesters' camp; Highway #3.

Photo 60. Local harvesters' camp; Hwy. #3.

Photo 61. About 20 local harvesters camp here.

Photo 62. Abandoned morel sun drying rack.

Photo 63. Abandoned outhouse at camp site.

Table 1. Numbers of Morel Mushroom Harvesters in the Northwest Territories in 2015.

NWT Morel Harvest in 2015	Estimated numbers of Morel Harvesters & Entrepreneurs; number of Mushroom Buyers:						
Harvest Areas near NWT Communities	**Total All Harvesters**	**Subtotal Commercial Harvesters**	Northern Commercial **Harvesters**	Southern Commercial **Harvesters**	Northern Commercial **Entrepreneurs**	**Subtotal Recreational Harvesters**	**Total** Commercial **Buyers**
Whati	**30 - 35**	10				20 - 25	
Behchoko, Fort Providence, and Kakisa	2530	500	300	200	30 - 35	2000	5
Fort Simpson	**2**	2	2				
Great Slave Lake area	**6**	1	1			5	
Hay River, Fort Smith, Enterprise, Fort Resolution, and Lutsel K'e	**355 - 405**	5			5	350 - 400	
Wood Buffalo Park	**50 - 60**					50 - 60	
Totals	**2973 - 3038**	518	303	200	**35 - 40**	2425	**5**

7.2.2. Harvesters in Other Areas

About 20 - 25 residents from Whati harvested morels regularly from mid June to mid August. Only six harvesters were known in the Great Slave Lake area and at least two residents harvested near Fort Simpson. About 350 - 400 people from the South Slave and Dehcho regions attended the walking field workshops and 80 - 100 harvesters were reported in burns of the South Slave Region including several entrepreneurs (Table 1).

The Law Enforcement Branch, South West NWT Field Unit, Parks Canada Agency, reported that there were no known occurrences regarding potential illegal commercial harvesting of morel mushrooms in Wood Buffalo National Park in 2015. Approximately 20 - 25 individuals or individual groups of local indigenous people, who are allowed harvesting mushrooms in the park for personal use, were encountered. Two non-indigenous people who appeared to be scouting burned areas but had no morel mushrooms were asked to leave. Members of the public reported less than 10 non-indigenous people who appeared to have the intent to harvest morels in the park. Parks enforcement officers had acted on these reports but upon investigation no one was found harvesting within the park boundaries. Also, the expected or potential influx of

parked cars from commercial morel harvesters beside roads inside the park did not happen.

8.0. HARVEST AND INCOME

8.1. Harvester's Income

8.1.1. Prices paid to Harvesters in 2015

In 2015, 4 of 5 buyers onsite paid $7/lb. (500 grams) of fresh morels to harvesters and occasionally only $6/lb. (depending on the quality and size of morels). This was nearly 50% lower than last year's price of $10 to $14/lb. paid to harvesters for fresh morels in the Dehcho Region. The fifth buyer, a First Nation buyer, paid $8.50/lb. of fresh morels to residents in Fort Providence for a while before lowering the price to $7/lb. For sun dried morels three buyers onsite paid $70 to $75/lb. in 2015. Wholesalers in BC offered northern buyers and entrepreneurs $170/lb. of flash-dried and sun dried morels at the end of the harvest season.

8.1.2. Harvester's Income at Kakisa, Fort Providence and Behchoko

The beginning of the harvest was slow in the Kakisa area and the income of harvesters was meager for the first week from May 22 - 29. Most novice southern and foreign harvesters delivered merely from 1 - 3 lbs. of fresh young morels per person/day during the first few days of the harvest from May 22 - 24. They earned only from $6 to $21 per person/day. A few experienced local people harvested 10 - 15 lbs./day and even up to 30 lbs./day of mature fresh morels already by May 24 in old burns near Fort Simpson and on May 26 north of Fort Providence. They sold their morels to the two BC buyers in the Kakisa area and earned from $60 to $210 per person for a few days. By June 04, everybody had left the Kakisa area and joined the harvest near Fort Providence.

At the beginning of the harvest north of Fort Providence from May 25 - June 04, most harvesters picked from 15 - 20 lbs. of fresh morels per person/day, thus earning between $90 and $140/day at the $7/lb. being paid for fresh morels. From June 04 - July 01, most harvesters picked from 20 - 30 lbs. and earned between $140 and $210/day. Avid harvesters and fast learners with a sense for prime morel habitats picked from 30 - 40 lbs. and earned between $210 and

$280/day. From June 10 - July 01, a few experienced harvesters were able to pick 40 - 50 lbs. occasionally, thus earning between $280 and $350 per person on some days. Several aboriginal families camping in the burns with their children and teens for a few weeks earned $500 to $600/day per family in a team effort and up to $900 on some days. From July 04 - 25, morels grew so big and abundant in prime habitats that even some novice harvesters were able to pick 10 lbs. of fresh morels per hour or 40 - 50 lbs. in an afternoon. They earned between $240 and $300 per person for half day work or $60/hour at the lower price of $6/lb. being paid for fresh morels at that time (Photos 64 to 69).

Based on interviews with harvesters, the estimated total income for about 150 northern and 50 - 60 southern fulltime harvesters selling morels to buyers until July 01 was as follows. For about 100 - 125 harvesters the income ranged from $3,500 - $6,000/person (average of $4,750/person) for 25 - 30 work days during a period of 34 harvest days from May 29 - July 01. About 40 - 50 avid northern and southern harvesters earned an estimated $6,000 - $9,000/person (average of $7500/person) during the same period. Another 40 - 50 northern harvesters earned an estimated $9,000 - $12,000 (average of $10,500) during a period of 58 harvest days from May 29 to July 22.

The income of harvesters increased by 26 - 30% when selling sun dried morels to roadside buyers because for a pound of dried morels they were paid as if it was 10 lbs. of fresh morels although it only took 7.5 - 8.5 lbs. of fresh morels to produce 1 lb. of dried morels. In addition, they got an extra $5/lb. of dried morels or a total of $70 - $75/lb. of dried morels. Two local people sold their crop directly to BC wholesalers for $170/lb. of dried morels. Two northern harvesters sold fresh morels at the farmers market in Yellowknife including one person selling them for $12 - $15/oz. and making a "few hundred dollars" and the other person selling giant morels for $1 per morel. Another northern harvester sold fresh and dried morels to local restaurants and grocery stores.

8.1.3. Harvester's Income in other Areas and Communities

In Whati, about 20 - 25 residents harvested morels from mid June to mid August. Several shipments of sun dried and fresh morels were flown out and sold to buyers between Behchoko and Fort Providence until late July. About 10 locals sold morels in excess of $1,000 per person. After the buyers left, locals kept sun dried morels for personal use and later marketing. During a recreational trip in early July, a person from Yellowknife picked 120 lbs. of fresh morels on Simpson

Island and around Francois Bay, Great Slave Lake, during a few hours/day for six days and sold some morels for a few hundred dollars.

A Hay River harvester picked from 40 - 60 lbs./day of fresh morels for 10 days and sold some of his dried jumbo morels for a total of "about $10,000" in restaurants in Calgary and Banff. Some packages of dried morels sold for $55/oz. and others for $375/lb. Three people from Fort Smith camped in an inaccessible burn northeast of Fort Smith for at least a month and sold their sun dried morels for "about $75,000 CAD". Another person from Fort Smith harvested morels worth "$800 on his best day" and sold his crop on his own. Reportedly, many residents from Fort Smith harvested morels in remote burns outside the park. Two harvesters sold morels at the farmers market in Hay River. A harvester from Fort Resolution picked from 40 - 50 lbs./day of fresh morels for 12 days. Another harvester picked about 40 lbs. per day for several days in the South Slave Region. Several South Slave harvesters turned into entrepreneurs.

8.2. Buyer's Crop and Income

8.2.1. Southern Buyers

Mushroom buyers from BC stated that in 2015 they earn $1/lb. for every pound of fresh morels they buy for the southern wholesalers for whom they work. On top of that, they get modest daily contract wages, expenses paid and equipment provided by wholesalers. A team of two BC buyers in the Kakisa area bought the first few pounds of fresh morels beginning May 21 with 34 lbs. on May 22; 125 lbs. on May 23; 170 lbs. on May 24; 200 lbs. on May 25; and 250 to 300 lbs./day from May 26 to 28. At their second buying station beside the gas station in Fort Providence, they bought 400 lbs. of fresh morels on May 29; 600 lbs. on May 30; and 1,000 lbs. on May 31. From June 01 to July 01, they bought as much as 2,000 to 3,000 lbs. of fresh morels per day and large quantities of sun dried morels. They bought morels over a period of 38 harvest days and ended up with a total of 15,000 lbs. of flash-dried morels (all values in metric lbs. or 500 grams/lb). The equivalence of this amount in fresh weight ranged from 112,500 to 127,500 lbs. of fresh morels. They shut down operations at the beginning of July because they already reached the desired quantity of dried morels their wholesale company wanted to buy.

Another BC buyer bought fresh and sun dried morels and bagged at least an estimated 5,000 lbs. of flash-dried morels during 39 harvest days from June 14 to

July 22 and possibly a few days longer. At a conservative estimate, all three BC buyers combined ended up with approximately 20,000 lbs. or 10 tons of flash-dried morels which equaled from 150,000 - 170,000 lbs. of fresh morels (Table 2).

8.2.2. Northern Buyers and Entrepreneurs

A buyer from Yellowknife took in a total of 3,000 lbs. of prime quality flash-dried morels during about 60 harvest days between Fort Providence and Behchoko. The total crop of the second northern buyer was estimated at 1,000 lbs. of flash-dried morels harvested during a period of at least a month. About 30 - 35 northern entrepreneurs operated private harvests between Fort Providence and Behchoko.

It was widely believed by insiders, authorities and the morel workshop instructors, that the combined commercial harvest intake by northern buyers and entrepreneurs likely exceeded the crop of the three southern buyers. Northern harvesters, buyers and entrepreneurs not only outnumbered their southern counterparts by far but they also harvested a sudden bumper crop with large morels for an additional 3.5 weeks after nearly all Southerners and two BC buyers were gone. Some locals harvested morels for an additional 5.5 weeks after all Southerners left. Based on the data from the main harvest area between Fort Providence and Behchoko, a conservative estimate concluded that about 15,000 lbs. of flash-dried morels most likely represent the combined total commercial crop of all northern buyers, entrepreneurs, and individual harvester-turned-entrepreneur. This figure represents only 75% of the southern buyer's crop and is likely an underestimate (Table 2).

Plate 12. Morel Harvesters near Kakisa, Fort Providence and Behchoko.

Photo 64. The first baby morels, May 18, 2015.

Photo 65. Harvesters sun drying their morels.

Photo 66. Picked 10 lbs. of morels in one hour.

Photo 67. A resident picked 45 lbs. in 4 hours.

Photo 68. Morel mushroom buying station.

Photo 69. Harvesters line up at buying station.

8.3. Commercial and Private Harvest Totals

a) Main harvest area between Fort Providence and Behchoko

- The total commercial morel harvest from all parties (Northerners and Southerners) along Highway #3 was estimated at 35,000 lbs. (17.5 tons) of flash-dried morels (or 262,500 - 297,500 lbs. of fresh morels).

- About 2,000 northern recreational harvesters picked morels for personal use. Their total harvest was estimated at 40,000 lbs. of fresh morels.

- The combined commercial, private and recreational harvests from all parties (Northerners and Southerners) was estimated at 40,000 lbs. (20 tons) of flash-dried morels (or 300,000 - 340,000 lbs. of fresh morels) (Table 2).

b) Other Harvest Areas

Based on the available information from other burns in the South Slave, North Slave and Tlicho regions, the estimated total crop ranged from about 10,000 - 15,000 lbs. of fresh morels (Table 2).

Table 2. Amounts and Value of Harvested Morels in the Northwest Territories in 2015.

Estimated amounts of harvested Morels, Cash paid to harvesters, and End Market Value of Morels:				
Harvest Areas	**Commercial Morel Mushroom Harvest**		Total Cash paid by 5 Buyers to Harvesters	**Total**
Communities or Region	Pounds (500 g) **Fresh Morels**	Pounds (500 g) **Dried Morels**	**Cash paid $ CAD**	**End Market Value $ CAD**
Whati	1,500 - 2,100 lbs.	250 lbs.	$13,000 - $15,000	$56,000 - $70,000
Highway #3 from Behchoko to Fort Providence	262,500 - 297,500 lbs.	35,000 lbs.	$1.4 million	$9.8 - $16.3 million
South Slave Region (*)	2,300 - 2,500 lbs.	300 lbs.	(2 entrepreneurs)	$85,000 - $90,000
Total	**266,300 - 302,100 lbs.**	**35,550 lbs.**	**$1.413 - $1.415 million**	**$9.941 - $16.46 million**
	Recreational Morel Mushroom Harvest			**Total**
	Pounds (500 g) **Fresh Morels**	Pounds (500 g) **Dried Morels**		**End Market Value $ CAD**
Behchoko to Fort Providence	40,000 lbs.	4,700 - 5,300 lbs.		$1.316 - $1.484 million
All other areas	10,000 - 15,000 lbs.	1,200 - 2,000 lbs.		$336,000 - $560,000
Total	**50,000 - 55,000 lbs.**	**5,900 - 7,300 lbs.**		**$1.652 - $2.044 million**
	Combined Commercial & Recreational Morel Harvest (numbers rounded up in thousands):			
	Pounds (500 g) **Fresh Morels**	Pounds (500 g) **Dried Morels**		**End Market $ Value $ CAD**
Behchoko to Fort Providence	300,000 - 340,000 lbs.	40,000 lbs.		**$15.0 million** ($11.2 - $18.6 M)
All Harvest Areas	**310,000 - 355,000 lbs.**	**41,000 - 42,000 lbs.**		**$15.4 million** ($11.5 - $19.1 M)

Note: (*) = Based on only two entrepreneurs; is not representative of the entire South Slave Region.

9.0. ECONOMY AND MARKET VALUE OF MORELS

9.1. Northern Economy

This section summarized the economic benefits only from the main harvest area between Fort Providence and Behchoko (the figures are based on Sections 8.2., 8.3. and 9.3).

All three BC buyers combined paid out an estimated total ranging from $1,050,000 to $1,190,000 CAD or a mean value of $1,120,000. When adding the higher price paid for sun dried morels then the total cash payout by southern buyers to harvesters on Highway #3 was estimated at $1.2 million. About 75% of this money (or $900,000) went into the pockets of northern harvesters and 25% (or $300,000) to southern harvesters.

In addition, an estimated minimum of $200,000 was paid out in cash by two northern buyers and 30 - 35 entrepreneurs combined. The total cash paid to harvesters by all southern and northern buyers and entrepreneurs combined was estimated at $1.4 million of which northern harvesters pocketed about $1.1 million and southern harvesters $300,000.

Adding an estimated $500,000 of spin-offs for local businesses such as gas stations, coffee shops, restaurants, food and hardware stores, then the morel harvest generated an instant total cash flow of about $1.9 million going into the pockets of harvesters and northern businesses. Approximately $1.7 million stayed in the NWT and only $200,000 went south with southern harvesters after they spent an estimated $100,000 of their combined total income in the NWT.

The end market value of about 15,000 lbs. of flash-dried morels harvested commercially and owned by all northern buyers and entrepreneurs combined was estimated at $5.6 million. If all is sold, most of the money will come from Southern Canada, USA and overseas and much of it will stay in the NWT economy.

The private and recreational harvest intake by northern residents was estimated at 5,000 lbs. of dried morels representing a value of $1.9 million. Most of these morels were likely kept for personal consumption.

9.2. Market Value of NWT Morels

The calculations in the points below were based on the near-lowest and near-highest market prices which ranged from $281 to $466 CAD for 500 g of dried Canadian morels during the period from September 2015 to February 10, 2016 (see Section 9.3). The large difference between the end market values reflects the cheaper bulk prices for 1 lb. of dried morels versus the higher returns by selling morels in small packages.

- The end market value of an estimated total of 40,000 lbs. (or 20 tons) of dried morels harvested for commercial and personal use by all parties (Northerners and Southerners) on Highway #3 was estimated at a mean value of $15 million (ranging from $11.2 to 18.6 million).

  These values include the following:

- 35,000 lbs. of flash-dried morels harvested commercially by all parties (northern and southern buyers/entrepreneurs) with a mean value of $13 million (ranging from $ 9.8 to $16.3 million).

- 15,000 lbs. of flash-dried morels harvested commercially by northern buyers/entrepreneurs with a mean value of $5.6 million (ranging from $4.2 to $7 million).

- 20,000 lbs. (or 10 tons) of dried morels harvested for commercial and personal use by northern residents with a mean value of $7.5 million (ranging from $5.6 to $9.3 million).

9.3. Current Market Value of Morels

The following prices of dried morels were obtained online from eBay and from the websites of several Canadian mushroom companies. On September 24, 2015, the end market prices in Canada and the USA for 1 lb. (454 g or 16 oz) of dried morels ranged from $135 to $ 299.99 United States dollars (or $199 to $444 Canadian for 500 g at the currency exchange rate in September) depending on the origin, quality, variety and quantity of morels per package. One of the biggest Canadian mushroom company offered packages of 15 g of dried morels for $14 Canadian (equals $467 for 500 g). Other Canadian wholesalers offered 1 lb. of dried blond morels from Behchoko for $190 USD (equaled $281 CAD for 500 g at the currency exchange rate in September).

By December 31, 2015, North American market prices for dried Canadian morels remained pretty much unchanged. Prices ranged from $22 to $25 CAD for 1 oz. (28 g) to $80 for 4 oz; and from $172 to $261 up to $387 CAD for 1 lb. (454 g or 16 oz) of dried morels (equals $426 for 500 g). Small packages of 15 g were still sold for $14 and 125 g for $124.99 (equals $500 for 500 g). An NWT morel mushroom company offered 1 lb. of dried morels for $250 CAD plus shipment.

By February 10, 2016, the morel prices remained very much the same as in previous months except for an NWT morel mushroom company offering 3 lbs. of dried morels for $500 CAD including free shipment.

9.4. Overall Value of Morels

All harvests between Fort Providence and Behchoko occurred along a 100-km-long stretch of burned forests beside Highway #3. Most harvest activities occurred within 1 - 2 km on both sides of Highway #3 and fewer harvesters ventured 5 km or further away from the road. Assuming that all harvesters covered 5 km on both sides of the highway (or a 10-km-wide band) and leaving not a single morel mushroom behind (although plenty of morels and areas were left untouched) for a stretch of 100 km that would result in a harvested area of 1,000 square kilometres or 100,000 hectare (ha). The latter figure represents roughly 10% of the about 1,000,000 ha burns between Fort Providence and Behchoko. Not all areas within these 10% consisted of prime habitats for morels or produced prolific morel crops. The same applies for the remaining 90% of the burns. Considering that the figure of 10% is inflated and that not even half of the harvest season was actually used at full capacity it is safe to assume that not even 5% of the burns between Fort Providence and Behchoko were actually thoroughly harvested. Of these 5% not even half of the available crop was harvested. It seems that perhaps only 2.5% of the available crop in the entire 1.0 million ha burn was harvested between Fort Providence and Behchoko.

When applying the estimated mean value of $15 million CAD of the harvested crop representing only 2.5% of the available crop (100%) between Fort Providence and Behchoko then the resulting numbers would be in the hundreds of millions of dollars. These numbers would double when considering that roughly 2.0 million ha of the 3.4 million ha of burned forests in the southwestern

NWT provided morel habitats. Although this exercise used very rough numbers and estimates, it helps to understand the dimensions of the potential total value of morels in the southwestern NWT in 2015.

10.0. MISINFORMATION

10.1. Reaction of Markets to NWT Morel Harvest

Prior to the morel harvest in the NWT, the reaction of some of the largest mushroom companies in British Columbia to the online ITI morel mushroom guide was excited and echoed by the media. The CEO of a company was quoted that last year's morel mushroom prices cited in the ITI guide were "unrealistic". Another CEO warned that the morel prices in the ITI guide were "overstated" and are expected to fall by 50% in 2015. ITI passed this message on to the public through the GNWT website, social media and local media.

Not surprisingly, the buyers working for these companies paid only half price to harvesters in 2015 which was $6 to $7/lb. for fresh morels compared with $10 to $14/lb. in the Deh Cho Region in 2014. Surprisingly, however, the prices listed from September 2015 to February 10, 2016, by these and other companies were 55% to 64% higher than last year's prices (for current morel prices see below Section 7.1.2). In 2015, they ranged from $253 to $423 for 500 grams of dried morels compared with $170 to $300 in 2014 as it was cited in the ITI guide. These facts contradict the statements of both CEOs.

10.2. Misinformed Southern Harvesters

Southern and foreign harvesters claimed that ITI announced online the "harvest" would begin on May 10. This was incorrect because ITI and the morel workshop instructors clearly stated that a) the growing season of morels (not the harvest) in the southwestern NWT usually begins between mid to late May depending on mother nature; b) the walking field workshops may begin between May 20 - 25 at the beginning of the morel growing season to prepare local communities and give them a head start; and c) the morel harvests may slowly begin as early as May 20 to 25 (which proved to be true) but usually during the first week of June depending on moisture levels and warm temperatures.

Southern mushroom buyers said they would be on site by May 10 because they want to assess the habitats and best locations for buying stations long before the harvest begins. Therefore, the instructors of the ITI morel workshops announced that they also would be on site by May 10 in order to a) monitor the beginning of the morel growing season and the expected influx of southern harvesters following buyers on the road; b) to act as liaison between buyers, pickers and local communities to ensure that everything went smoothly; and c) to report about the progress of the growing season so that ITI can publicly announce the beginning of the field workshops and the harvest. These steps proved to be essential, helped easing tensions raised by a handful of young harvesters from Eastern Canada and enabled ITI to announce the beginning of workshops for May 25.

Other issues were that the southern mushroom buyers decided to accept undersized baby morels at the beginning of the harvest which caused eyebrows to be raised by northern buyers and experienced morel hunters. The complaints by mostly southern and foreign novice harvesters that the expected income of up to $400 – $500 per day was unrealistic was due to the 50% lower price paid by buyers. Also, these harvesters arrived 12 - 19 days before the harvest began and they left right before a bumper crop began growing for several weeks. The fact that many novice harvesters do not make much money or even go broke while experienced harvesters earn good money was well documented in publications about the morel mushroom harvests in Western North America from the US Pacific Northwest to BC, Yukon and Alaska (Pilz *et al*. 2007; Wiita and Wurtz 2005).

11.0. PROBLEMS

The Kakisa band warmly welcomed and invited a total of about 150 southern mushroom pickers for two barbeques (Photos 70 and 71). During a public meeting after the barbeques with all mushroom pickers in the area, the Kakisa band asked them very modestly and friendly to respect a late night curfew in the community including "no noise after 10 pm" and a 2 km no picking zone leading to their community. This plea was made after some initial disrespectful behaviour by a handful of young southern Canadian pickers using the local cemetery as a starting point for scouting morels and driving around after midnight in the community, partying, drinking, making noise, littering and using the plug-ins at the band office for charging their cell phones and computers. Fortunately, this plea was respected by all harvesters. Overall, harvesters were nice, friendly,

respectful and careful people of all age classes, gender and cultural backgrounds. There were no concerns or incidents reported from all other harvest areas in the South Slave and North Slave regions.


Photos 70 and 71. Kakisa Chief Lloyd Chicot and band hosted barbeques at their own expense for a total of 150 hungry southern harvesters before the beginning of the harvest.

12.0. SAFETY

Local and regional authorities and enforcement officers from various territorial and federal government departments took turns in patrolling highways, camps and mushroom buying stations. There were no reports of vehicle accidents, offenses, crimes, interference with wildlife or bear-human conflicts except for two bears being chased away with bear bangers at a camp (Photos 72 and 73). Only one harvester got lost, for nine hours, but according to the RCMP, eventually he found his way back to safety without help. The harvester was part of a group which had an emergency plan in case somebody got lost. They used one of the well visible radio towers as a landmark and muster point.

13.0. GARBAGE

Most people kept and left camp sites clean except for littering by a handful of young Southern Canadians to the embarrassment of others from the same region. During the morel harvest, some garbage containers at roadside turnoffs along Highway #3 overfilled thus prompting authorities to deliver additional dumpsters and provide more frequent maintenance. At the beginning of July, or 3.5 weeks before the end of the peak morel harvest, departing southern and northern harvesters left tons of reusable equipment nicely piled up at roadside

turnoff dumpsters including mushroom buckets, drying screens, tarps and camping equipment. Some of the materials were scavenged by northerners who continued harvesting for another three weeks and longer (Photos 74 to 77).

Plate 13. Wildlife, Morel Equipment and Garbage.

Photo 72. Bison beside Highway #3.

Photo 73. Black Bear beside Highway #3.

Photo 74. Garbage piling up at roadside turnoff; authorities did set up more dumpsters.

Photo 75. New dumpster; mushroom buckets and equipment left behind by harvesters.

Photo 76. Mushroom drying screens.

Photo 77. Burned cans left behind by some.

14.0. CONTAMINANTS

The NWT morel harvest in 2015 occurred in areas which were tested more than a decade ago for heavy metals in morels, other mushrooms, trees and soil (Obst 2014). There were no concerns regarding heavy metals in morels from the 2015-harvest areas from Kakisa to Fort Providence to Behchoko and Whati, as well as for several other areas in the North Slave and South Slave regions. In fact, these NWT morels were more pristine than samples of morels received for analysis from BC and Alaska. The issue of heavy metals in edible wild mushrooms is addressed in the above cited report which is under review for publication.

15.0. MUSHROOM MANAGEMENT AND LEGISLATION

The issues of the management of edible wild mushroom resources and legislation for harvests was raised by members of the public and politicians prior and during the 2015-harvest of morels. The management of wild mushrooms was well researched in the US Pacific Northwest in order to ensure ecologically responsible and sustainable harvests and renewable wild mushroom resources. There were no concerns regarding the harvest of morel mushrooms growing in burned forests (Pilz *et al*. 2007). For some other species of prized edible wild mushrooms science-based protocols for management, legislation and regulations were developed and applied in some jurisdictions in the USA. Since the issue of potential legislation of wild mushroom harvesting was discussed in the NWT, the following selected literature is recommended for consultation: Pilz *et al.* 1999; Liegel *et al*. 1998; McLain *et al.* 1998; Hosford *et al.* 1997; Molina *et al*. 1997 and 1993; Pilz and Molina 1996.

In Canada, forestry and agricultural government departments, and independent researchers, have been promoting the sustainable harvests of wild mushrooms (Brubacher and Associates 1999; Mohammed 1999; Duchesne and Weber 1993). In the North, the commercial harvest of morel mushrooms is an established industry in the Yukon Territory (Yukon Government 2014; Kenney 1996), a growing industry in the Northwest Territories (ITI 2015; Obst and Brown 2000; Green 1989), and an irregular industry in Alaska (Wiita and Wurtz 2005).

16.0. CONCLUSION AND RECOMMENDATIONS

The morel mushroom resource, and the economic and environmental feasibility of harvests, is widely recognized. The NWT morel harvests in 2015 and 2014 demonstrated that the NWT has the morels and thus the potential to become a major supplier for the global market in a sustainable and environmentally friendly manner. In order to achieve this goal and to foster and safe-guard a mushroom industry in the NWT, the author of this report recommends to continue with the education of the public because education is the single most important tool and harvesting and marketing experience are necessary and need to be emphasized. Lessons learned from the 2015 harvest will result in increasing participation of communities, enhanced profits, and better preparation for the harvest of NWT morels in June and July of 2016, and in the future. Also recommended is to explore similar harvest opportunities with other northern species of edible and medicinal wild mushrooms and wild berries.

17.0. PERSONAL COMMUNICATIONS

Bruce Green, retired Biology Teacher, mushroom expert, Hay River.

John Colford, retired ITI Manager, mastermind of morel workshops, Yellowknife.

Robert G. Bromley, retired Biologist, hobby mushroom harvester, Yellowknife.

Walter Brown, morel workshop instructor and mushroom expert, Yellowknife.

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19.0. LITERATURE CITED

Brubacher, D. and Associates. 1999. Non-timber forest products: exploring opportunities for aboriginal communities. Mitigaawaaki Forestry Marketing Co-operative, Ontario. 133 pp.

Duchesne, L. D., and M. G. Weber. 1993. High incidence of edible morel Morchella conica in a jack pine, *Pinus banksiana*, forest following prescribed burning. Can. Field-Nat. 107: 114 - 116.

Green, B. 1989. Wild mushrooms with known or possible commercial value existing in the South Slave and Decho regions of the N.W.T. Rep. prepared for GNWT Dept. of Economic Development and Tourism. 19 pp.

Hosford, D., D. Pilz, R. Molina, and M. Amaranthus. 1997. Ecology and management of the commercially harvested American Matsutake mushroom. Tech. Rep. PNW-GTR-412, U.S. Dept. Agriculture, Portland, OR. 68 pp.

ITI. 2015. A Harvester's Guide: Morel Mushrooms in the Northwest Territories. Prep. by W. Brown and J. Obst for the Dept. of Industry, Tourism and Investment (ITI), Traditional Economy, Agriculture and Fisheries, Government of the Northwest Territories. 20 pp. (available online).

Kenney, N.W. 1996. An overview of the Yukon Morel Mushroom industry. Yukon Government, Department of Economic Development, and Renewable Resources. Whitehorse, Yukon Territory.

Liegel, L., D. Pilz, T. Love, and E. Jones. 1998. Integrating biological, socioeconomic, and managerial methods and results in the MAB Mushroom Study. AMBIO spec. rep. no. 9, Sept. 1998. Royal Swedish Academy of Science, Stockholm: 26 - 33.

McLain, R., E. Jones, and L. Liegel. 1998. The MAB Mushroom Study as a teaching case example of interdisciplinary and sustainable forestry research. AMBIO spec. rep. no. 9, Sept. 1998. Roy. Swedish Acad. of Sci., Stockholm: 34 - 35.

Mitchell, M. and Associates. 1997. The Harvest, Market and Availability of Special Forest Products in the Manitoba Model Forest. Project: 95-4-09. 81 pp.

Mohammed, G. H. 1999. Non-Timber Forest Products in Ontario: An Overview. Ontario Forest Research Institute, Ministry of Natural Resources. Forest Research Information Paper No. 145. 64 pp.

Molina, R., T. O'Dell, D. Luoma, M. Amaranthus, M. Castellano, and K. Russell. 1993. Biology, ecology, and social aspects of wild edible mushrooms in the forests of the Pacific Northwest: a preface to managing commercial harvest. Tech. Rep. PNW-GTR-309, U.S. Dept. Agriculture, Portland, OR. 42 pp.

Molina, R., N. Vance, J. F. Weigand, D. Pilz, and M. Amaranthus. 1997. Special forest products: intergrating social, economic, and biological considerations into ecosystem management. In: Creating a forestry for the 21st century. The science of ecosystem management. Chapter 21, pp. 315 - 336. Island Press, Washington, D.C.

Obst, J. 2014. Heavy Metals in Soil and Edible Wild Mushrooms in the North Slave Region, Northwest Territories, Canada, and Assessment of the potential Human Health Risk from the Consumption of Edible Wild Mushrooms. Unpub. report for the Government of the Northwest Territories, Dept. Industry, Tourism and Investment, Traditional Economy, Agriculture and Fisheries, Yellowknife, NT. 178 pp.

Obst, J. and W. Brown. 2000. Feasibility of a Morel Mushroom Harvest in the Northwest Territories. Unpub. report prepared by Arctic Ecology and Development Consulting and Deton'çho Corporation for the Government of the Northwest Territories, Economic Development, Trade and Investment Office, Dept. of Environment and Natural Resources, Yellowknife, NT. 42 pp.

Pilz, D., R. McLain, S. Alexander, L. Villarreal-Ruiz, S. Berch, T. L. Wurtz, C. G. Parks, E. McFarlane, B. Baker, R. Molina, and J. E. Smith. 2007. Ecology and Management of Morels Harvested from the Forests of Western North America. US Dept. of Agriculture, Forest Service, Pacific Northwest Research Station, USDA General Technical Report PNW-GTR-710, March 2007. 161 pp.

Pilz, D., J. Smith, M. P. Amaranthus, S. Alexander, R. Molina, and D. Luoma. 1999. Mushrooms and Timber: Managing commercial harvesting in the Oregon Cascades. J. of Forestry, March 1999: 4 - 11.

Pilz, D. and R. Molina. 1996. Managing forest ecosystems to conserve fungus diversity and sustain wild mushroom harvests. Studies 1 - 13. Tech. Rep. PNW-GTR-371, U.S. Dept. Agriculture, Portland, OR. 104 pp.

Schlosser, W. E. and K. Blatner. 1997. Special forest products: An east-side perspective. USDA Pacific Northwest Research Station. PNW-GTR-380.

Wiita, A.L. and T.L. Wurtz. 2005. The Morel Mushroom Industry in Alaska: Current Status and Potential. Institute of Social and Economic Research and USDA Forest Service Boreal Ecology Cooperative Research Unit, University of Alaska, Anchorage and Fairbanks. 27 pp.

Yukon Government. 2014. Morel Mushroom Harvesting in Yukon. Yukon Dept. of Energy, Mines and Resources; Forest Management Branch. www.forestry.gov.yk.ca (online version June 2014). 8 pp.