

# Edible forest mushrooms of the Gaspé Peninsula (Québec, Canada)

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**UQAR**



# Context

Over 3 000 mushrooms species are known in Québec (Lamoureux et Sicard, 2001), part of it are edible, and sometimes highly valuable.

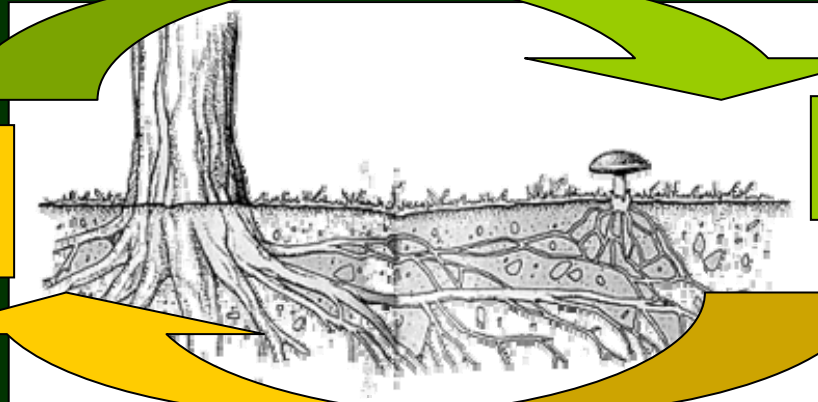
The harvest of those mushrooms (NTFP) currently generate great profits in Europe, Asia and North-West America (approx. 60 M\$ per year in B.-C.).

→ Most of choice species are symbionts of tree species.

## Benefits:

+ Water, N, K

(Danell, 1994)



photosyntats

(Lamoureux, 1993)

As the harvest of forest mushrooms do not kill the mycelium: those mushrooms are considered as a *renewable resource*



# Limiting factors (1/2)

Several **ecological characteristics** can influence the **distribution** and the **productivity** of fructification (Harley et Smith, 1983).

Those limiting factors may vary from one study to another, among **forest stand types**, and also within and between **seasons**.

## Biotic :

### *Spatial factors:*

- **forest stand type** (Lodge *et al.*, 2004);
- diversity of plants (Lodge *et al.*, 2004; Villeneuve, 2000);
- forest cover structure (Villeneuve, 2000);
- fragmentation of the cover and continuity of the spatial cover in time (Villeneuve, 2000).

Chanterelle

*Cantharellus cibarius*

Orange latex-milky

*Lactarius deterrimus*

## Limiting factors (2/2)

### Abiotic :

#### Edaphic factors:

- Humus and soil type, litter quality, soil fertility (Nantel et Neumann, 1992; Villeneuve *et al.*, 1991; Lodge *et al.*, 2004);
- Hydric regime ;
- Superficial deposits ( $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ).

Forest succession

→ fungic succession

#### Climatic and topographic factors:

- Temperature and humidity (Lamoureux, 1993);
- Altitude and latitude (Ohenoja, 1993);
- Distance to the coast (Villeneuve, 2000);
- Precipitations, probably the best indicator of the species richness and of the mushroom community structure (O'Dell, 1999).





# Research in Québec

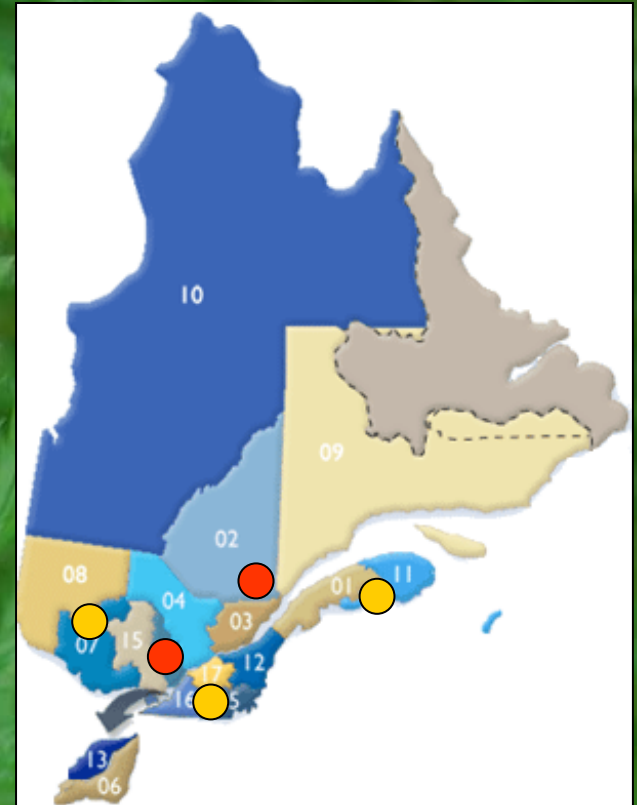
**1989-1993:** Study of the factors determining the repartition of forest mushrooms (Nantel et Neuman, 1992; Villeneuve et al. 1989, 1993)

**1993-5, Abitibi:** 2-yr harvest potential study and development of a survey protocol (Miron, 1994, 1995).

**1999-2000, Baie des Chaleurs, Gaspésie:** 2-yr harvest potential study in Spruce plantations following Miron's methods (Guérette, 2001).

**2003, Estrie:** 1-yr harvest potential study (Fallu, 2003).

**Knowledge** about the ecology of forest mushrooms and about the processus that drive their sprouting phenology are **incomplete**.



Hedgehog mushroom  
*Hydnum repandum*

Orange ring milkcap  
*Lactarius thyinos*

## Objectives

- 1) To establish the role of **forest cover** and **abiotic factors** in determining the **abundance** of selected edible mushroom species in Gaspé peninsula
- 2) To establish their **sprouting phenology**.

## Hypotheses

- 1) **Similar sites** will present similar fungic communities.
- 2) The **abundance** of fructifications will **vary** from one **site** to another **within a season**, but also **between seasons**.



# Methods

## Study area



The administrative region of the **Gaspé peninsula**: 21 099 km<sup>2</sup> (Gouvernement du Québec, 2005).

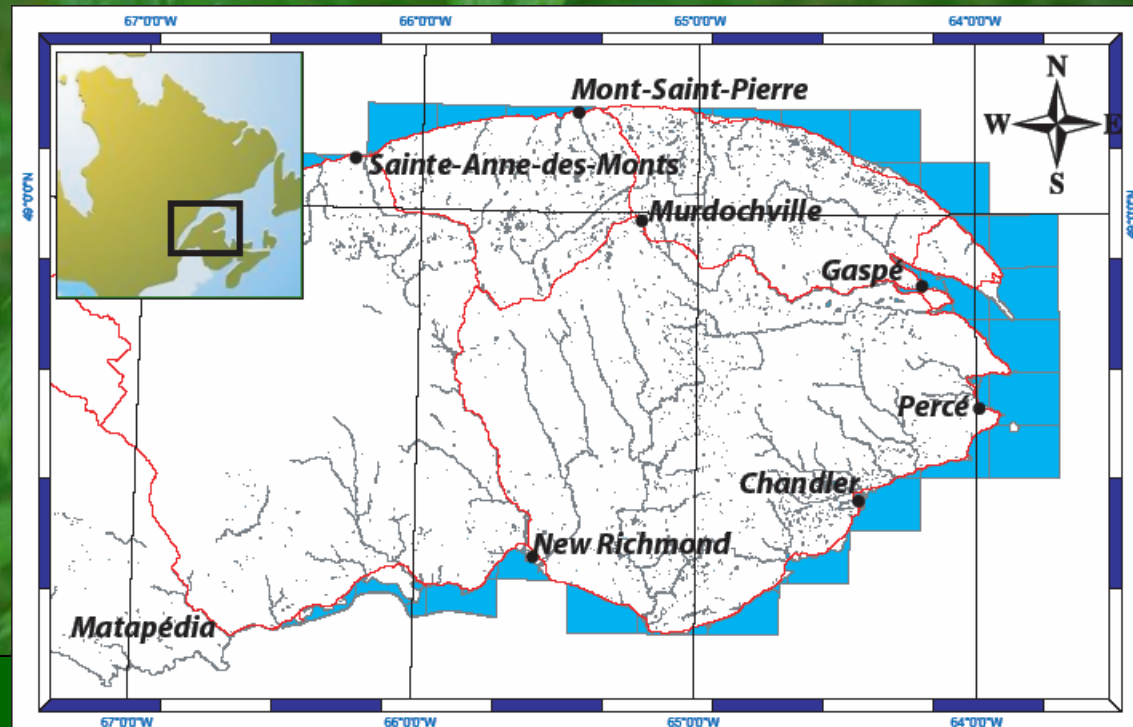
The growth season (>5 °C) , the amount of precipitations and the mean minimal and maximal temperatures vary greatly on the territory, due to the **altitude** and to the **maritime climate** (Environnement Canada, 2004).

→ **A great diversity of habitats**

High unemployment rate:

2005: 17.8% (Gaspésie) vs 8.2% (Québec)

**Economy based mainly on natural resources** : Fish industry, timber products, tourism



Source: Marie-France Gévry, 2006.

# Forest stand types

Natural forest stands :


Site selection:

-17 forest stand types representative of the territory and having a fungic potential.

30 yrs	Fir	Spruce	Fir & Spruce	Coniferous & deciduous forest	Deciduous forest
50 yrs	Fir	Spruce	Fir & Spruce	Coniferous & deciduous forest	Deciduous forest
70 yrs and over	Fir	Spruce	Fir & Spruce	Coniferous & deciduous forest	

Plantations :

30 yrs	White spruce	Norway spruce	Jack pine
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Lobster mushroom  
*Hypomyces lactifluorum*



# Surveys

Monitoring of **permanent plots** located systematically **along 500 m-transects**.

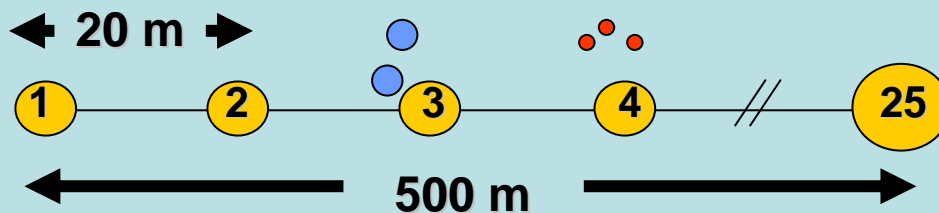
*Principal advantages:*

- is efficient when an exact habitat is unknown (Castellano *et al.*, 1999);
- allows long term studies and phenologic observations;

Total: **895 plots** along **39 transects** have been installed.

Surveys every 7 days, during 3 consecutive growing seasons (2005, 2006, 2007).

At each station: **Soil Temperature** and **humidity**,  
**number of sporocarps** (including parasited level),  
**mean weight** (fresh/dry).



	<b><i>Latin name</i></b>	<b><i>French name</i></b>	<b><i>English name</i></b>
1	<i>Catathelasma ventricosum</i>	Armillaire ventru	Swollen-stalked Cat
2	<i>Leccinum atrostitipitatum</i>	Bolet à pied noir	Black-stemmed Leccinum
3	<i>Boletus subglabripes</i>	Bolet à pied glabrescent	Glabrescent Boletus
4	<i>Boletus edulis</i>	Bolet comestible	King Bolete
5	<i>Lecinum piceinum</i>	Bolet des épinettes	Spruce Bolete
6	<i>Leccinum auranticum</i>	Bolet orangé	Orange-capped Bolete
7	<i>Suillus cavipes</i>	Bolet à pied creux	Hollow-stemmed boletus
8	<i>Cantharellus cibarius</i>	Chanterelle commune	Chanterelle
9	<i>Craterellus tubaeformis</i>	Chanterelle en tube	Trumpet Chanterelle
10	<i>Hypomyces lactifluorum</i>	Dermatose des russules	Lobster Mushroom
11	<i>Sarcodon squamosum</i>	Hydne squamuleux	Turtle Mushroom
12	<i>Hydnum umbilicatum</i>	Hydne ombiliqué	Umbilicate hydnum
13	<i>Hydnum repandum</i>	Hydne sinué /Pied de mouton	Hedgehog mushroom
14	<i>Lactarius deterrimus</i>	Lactaire des épinettes	Orange-latex milky
15	<i>Lactarius thyinos</i>	Lactaire du thuya	Orange ring milkcap
16	<i>Rozites caperata</i>	Pholiote ridée	Gypsy mushroom
17	<i>Tricholoma magnivelare</i>	Champignon des pins	Canadian Pine mushroom



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Orange latex-milky

*Lactarius deterrimus*

# Ecological characteristics

## *Stand characteristics measured:*

- Canopy cover and plant cover at 0,5 m;
- Basal area, number of stems;
- Plant species in place :
  - arbustive (sp.);
  - herbaceous (sp., %);
  - mousses (%);
  - lichens (%).
- Obstruction level of logs and branches on the ground;
- Stand age every 100 m along the transect.
  
- Edaphic and topographic parameters:
  - hydric regime;
  - slope (including position, aspect);
  - soil texture;
  - humus: decomposition, origin, type and thickness (Saucier, 1998);
  - litter thickness;
  - pH;
  - altitude.





# Preliminary results



1. Productivity / stand type
2. Productivity of species

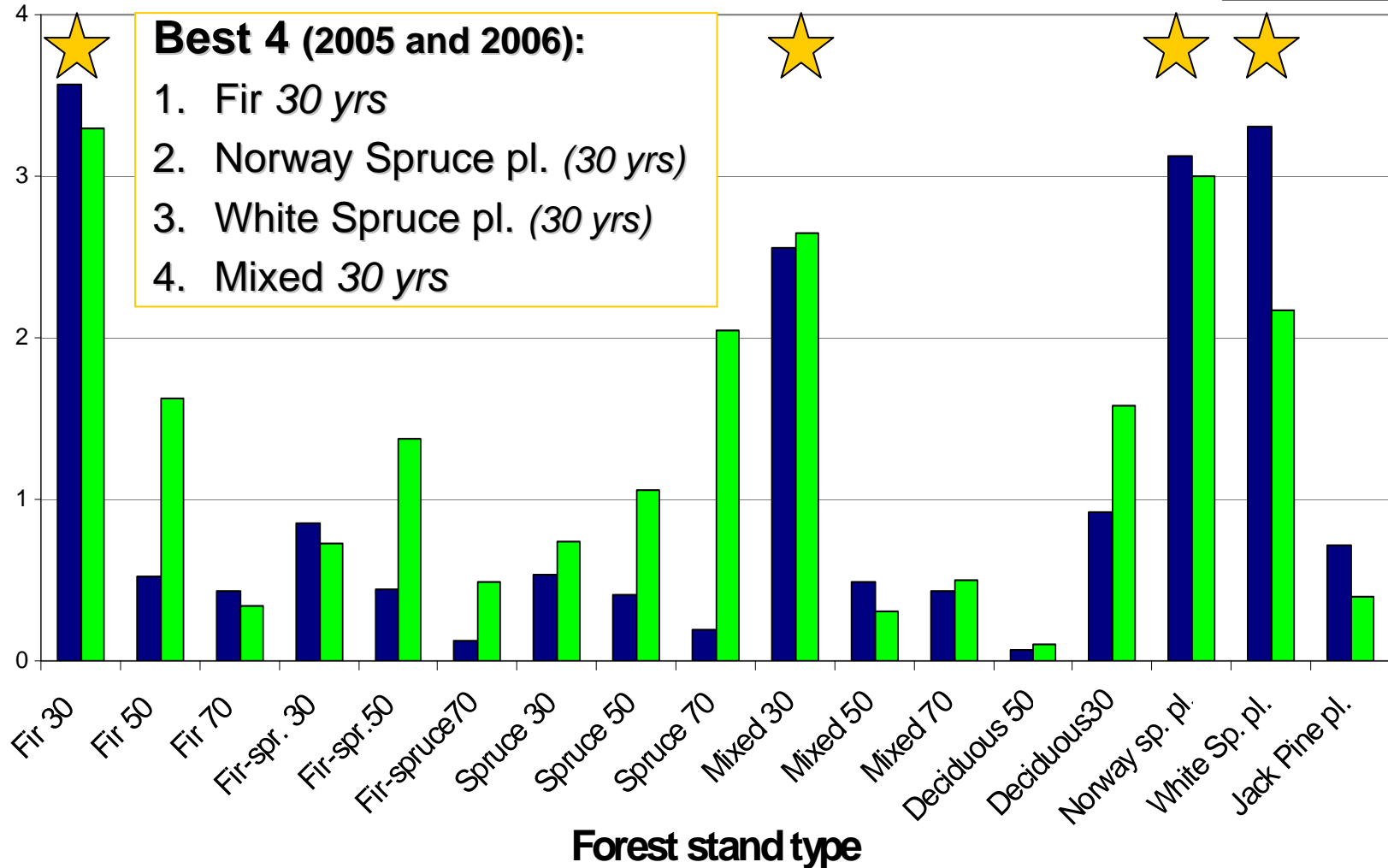
## Productivity of edible forest mushrooms per stand type (2005 and 2006)

■ 2005  
■ 2006

Occurrence of edible forest mushroom / station

**Best 4 (2005 and 2006):**

1. Fir 30 yrs
2. Norway Spruce pl. (30 yrs)
3. White Spruce pl. (30 yrs)
4. Mixed 30 yrs



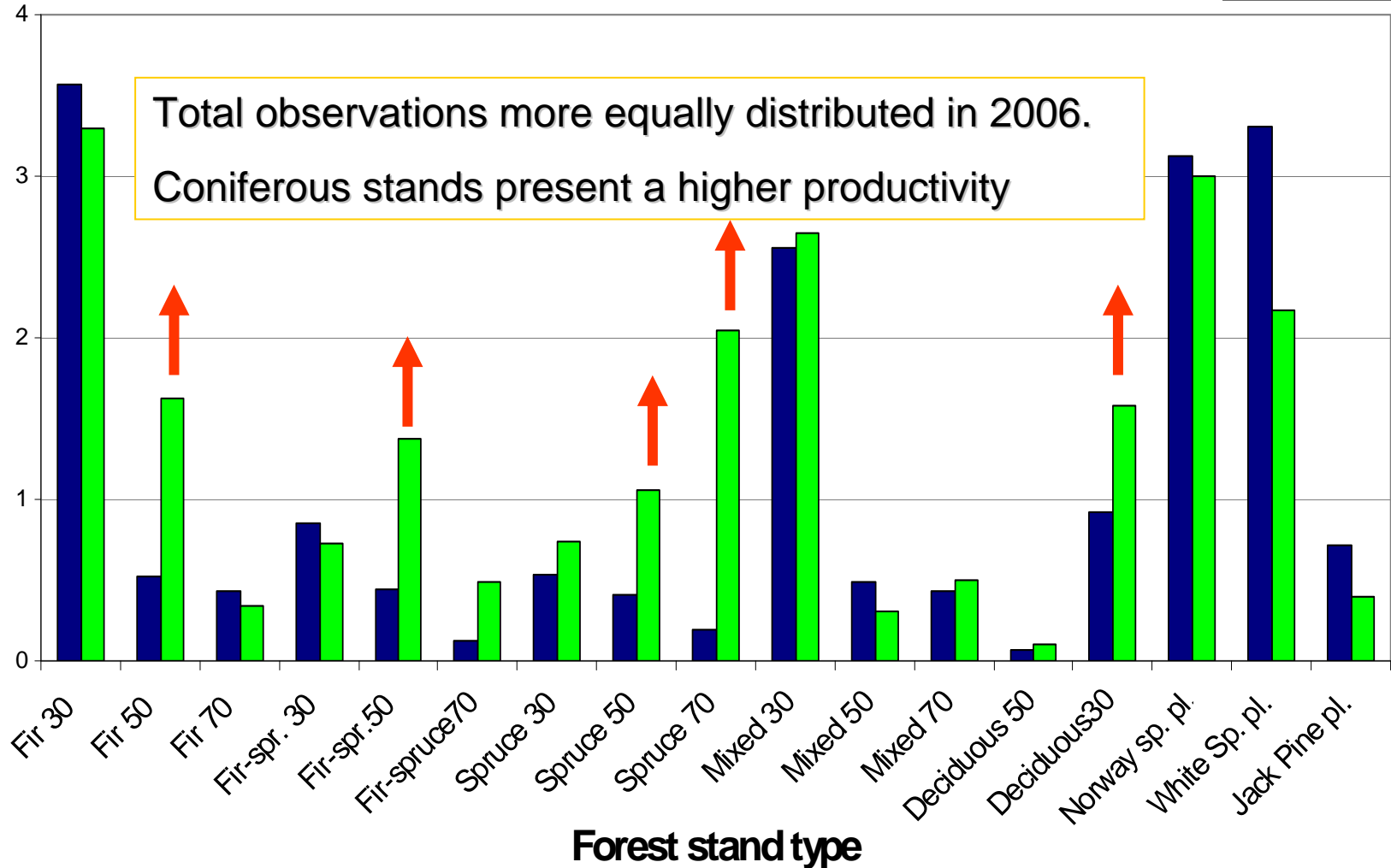


# Productivity of edible forest mushrooms per stand type (2005 and 2006)

■ 2005  
■ 2006

Occurrence of edible forest mushroom / station

Total observations more equally distributed in 2006.  
Coniferous stands present a higher productivity



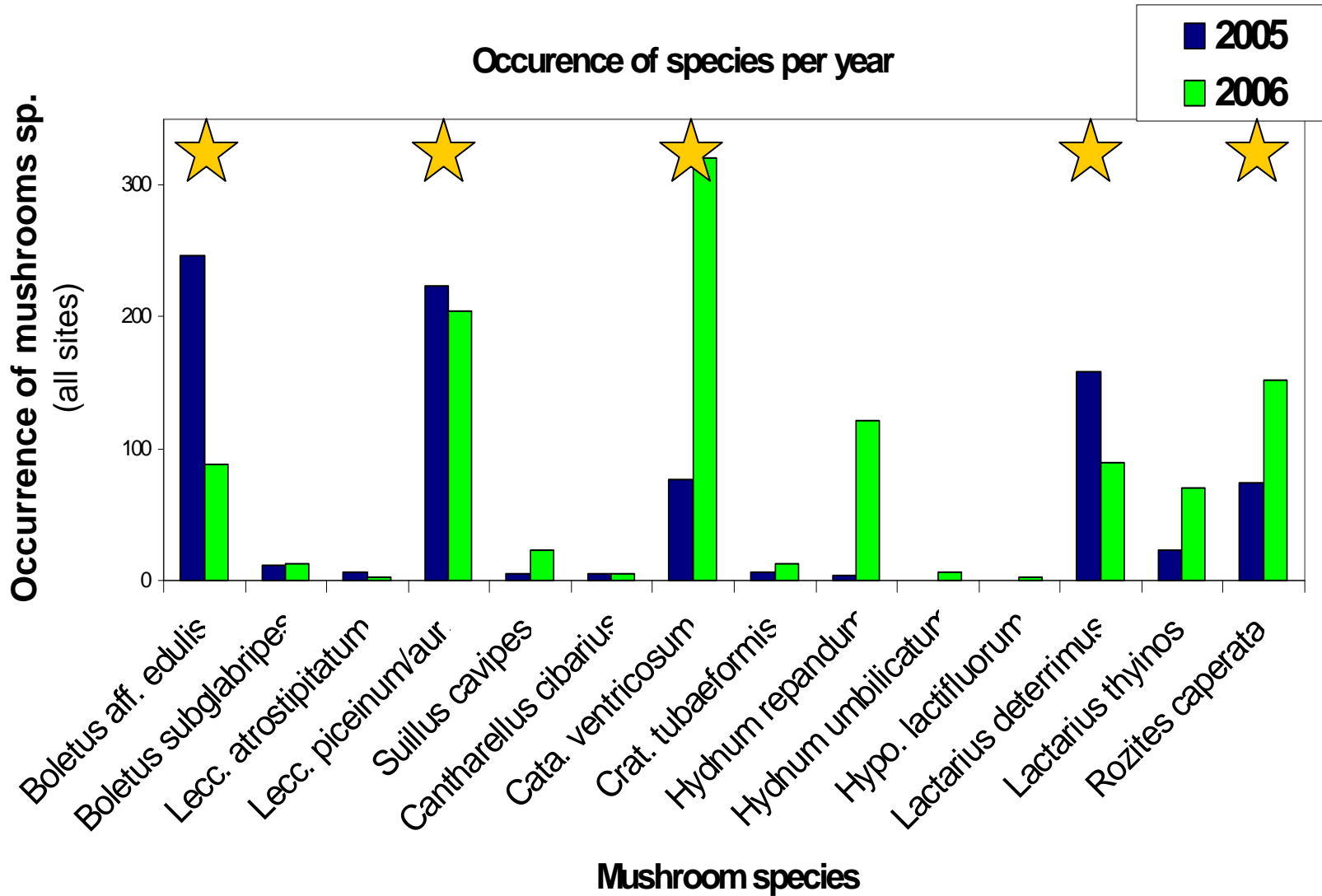
Forest stand type	Mushroom Richness		.+/-
	2005	2006	
Mixed forest 30	5	11	6
Fir 50	6	11	5
Spruce 50	4	9	5
Spruce 30	5	8	3
Spruce 70	4	7	3
Fir-Spruce 70	3	6	3
Fir 30	6	8	2
Fir-Spruce 50	9	10	1
Jack pine pl.	1	2	1
Norway spr. pl.	3	4	1
Deciduous 30	5	6	1
Deciduous 50	1	2	1
Fir-Spruce 30	7	7	0
White spr. pl.	6	6	0
Mixed forest 50	8	7	-1
Mixed forest 70	6	5	-1
Fir 70	7	3	-4

- Mushroom species richness has increased for most of the stands, with a mean of richness increment of 1.52.

- High productive stands showed similar specific richness between years, except for Mixed forest 30 yrs.



Hedgehog mushroom  
*Hydnum repandum*



**5 key-species** in both years; high variability for the others.  
**31,79% more mushroom occurrences in 2006.**



# KEY species of Gaspé peninsula

Spruce bolete  
*Leccinum piceinum*



Swollen-stalked Cat  
*Catathelasma ventricosum*



3

King Bolete  
*Boletus aff. edulis*



4

Gypsy mushroom  
*Rozites caperata*



5

Orange latex-milky  
*Lactarius deterrimus*





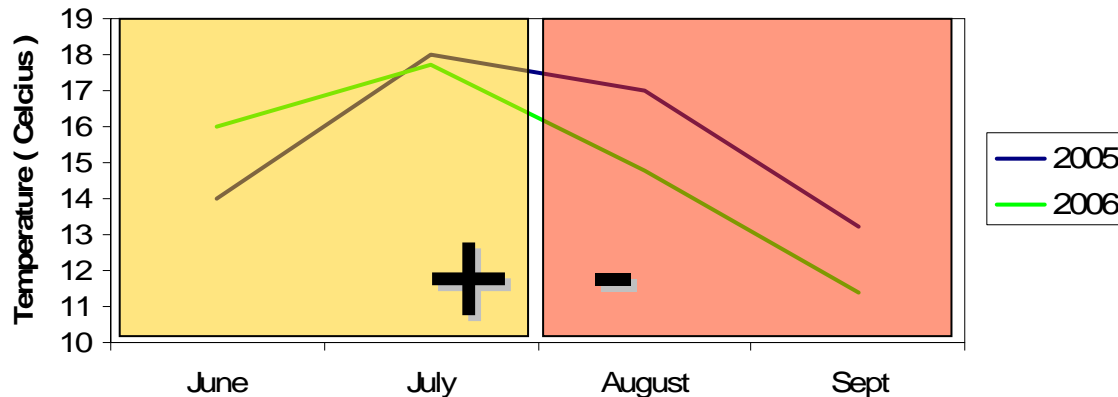
## Species rank per season

	2005	2006	2005 & 2006
<b><i>Leccinum piceinum/aur.</i></b>	2	2	1
<b><i>Catathelasma ventricosum</i></b>	4	1	2
<b><i>Boletus aff. edulis</i></b>	<b>1</b>	<b>6</b>	<b>3</b>
<b><i>Lactarius deterrimus</i></b>	3	5	4
<b><i>Rozites caperata</i></b>	5	3	5
<i>Hydnum repandum</i>	12	4	6
<i>Lactarius thyinos</i>	6	7	7
<i>Suillus cavipes</i>	11	8	8
<i>Boletus subglabripes</i>	7	9	9
<i>Craterellus tubaeformis</i>	9	9	10
<i>Leccinum atrostitipitatum</i>	10	12	11
<i>Cantharellus cibarius</i>	8	11	12
<i>Hydnum umbilicatum</i>	N/A	10	13
<i>Hypomyces lactifluorum</i>	N/A	12	14

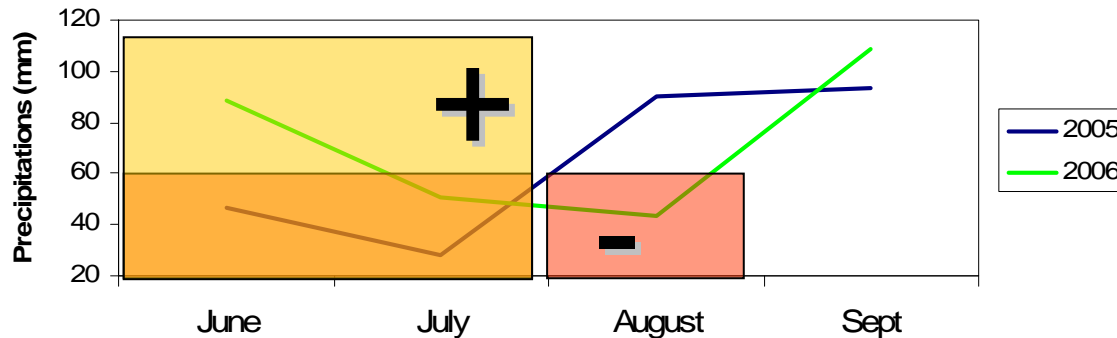
Nevertheless, there is a **high variability** of occurrence for the **majority of mushroom species !**

# First suspect: **the climate**

Mean Temperature, Gaspé City



Mean Precipitations, Gaspé City



Summer 2005 as been warmer, but the amount of precipitations was not sufficient until August.

Summer 2006 was warmer in June, had similar temperature in July and then was cooler. Great amount of precipitation were observed in June and July but low precipitation in August seems to have suddenly « broke » the season.



# Conclusion

The harvest of edible forest mushrooms would be interesting, especially in **Spruce plantations** and **young Fir stands**:

- a **high productivity** of a **limited number of choice species**
- present **lesser fluctuations** in response to the variation of the climate.

**Harvests in coniferous stands** would be interesting in some years, as those stands have a high productivity **when precipitation is sufficient**.

Surveys near the **coast** will be necessary to assess the site potential, especially for **Chanterelle** and **Lobster mushroom**.



# Looking further

The harvest of edible forest mushrooms in Gaspé peninsula would contribute :

1. to **diversify the forest resources** ;
2. to the **valorization of lands** ;
3. to **provide annually substantial incomes** to owners/pickers, **without compromising benefits earned from timber products.**





# Acknowledgement

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***Questions ?***