

Regulatory Guidelines for Wild Harvested Mushrooms



**ASSOCIATION OF FOOD
& DRUG OFFICIALS**
SINCE 1896

2021

**A reference from the Association of Food & Drug
Officials for state, local and tribal regulatory
authorities to use in conjunction with the 2013 or 2017
FDA Food Code § 3-201.16.**

Disclaimer: People who harvest, eat, or sell wild mushrooms should do so at their own risk. While every effort has been made to ensure that the information contained in this document is correct, the authors caution against the use of this information in any particular application and accept no responsibility or liability for errors, omissions or representations, expressed or implied, contained herein. Neither the authors nor AFDO accept responsibility or liability for errors people may make in identifying mushrooms or for harmful reactions to eating poisonous mushrooms.

The Association of Food & Drug Officials (AFDO)

1st Edition

November 2021

TABLE OF CONTENTS

Introduction.....	1
The Purpose of This Document.....	2
FSMA Produce Safety Rule.....	2
Model Guidance.....	3
Harvesting and Permits.....	3
Wild Mushroom Species of Culinary Value	4
Hen of the Woods or Maitake (<i>Grifola frondosa</i>).....	5
Chanterelles (<i>Cantharellus</i> , <i>Craterellus</i> , <i>Gomphus</i> , and <i>Polyozellus</i>).....	6
Golden Chanterelle (<i>Cantharellus cibarius</i>).....	7
White Chanterelle (<i>Cantharellus subalbidus</i>).....	8
Tube Chanterelle or Yellowfoot (<i>Craterellus tubaeformis</i>).....	9
Horn of Plenty (<i>Craterellus fallax</i> or <i>cornucopioides</i>).....	10
Hedgehog Mushrooms (<i>Hydnum repandum</i> , <i>H. umbilicatum</i> , <i>H. albidum</i> , <i>H. albomagnum</i>).....	11
Common or Giant Puffball (<i>Calvatia gigantea</i>).....	12
Cauliflower Mushroom (<i>Sparassis crispa</i>).....	13
Chicken of the Woods (<i>Laetiporus sulphureus</i> and <i>L. cincinnatus</i>).....	14
Lion’s Mane or Bearded Tooth (<i>Hericium erinaceus</i> , <i>H. americanum</i> , <i>H. abietis</i>).....	16
Boletes.....	17
King Bolete or Porcini (<i>Boletus edulis</i>).....	18
Queen Bolete (<i>Boletus regineus</i>).....	19
Matsutake (<i>Tricholoma matsutake</i> , <i>T. magnivelare</i> , <i>T. foucoulli</i>).....	20
Wood Blewit (<i>Clitocybe nuda</i> or <i>Lepista nuda</i>).....	21
Morels (<i>Morchella</i> spp.).....	22
Pearl Oyster Mushroom (<i>Pleurotus ostreatus</i>).....	23
Indian Oyster Mushroom (<i>Pleurotus pulmonarius</i>).....	24
Aspen Oyster Mushroom (<i>Pleurotus populinus</i>).....	25
Shaggy Mane (<i>Coprinus comatus</i>).....	26
Lobster Mushroom (<i>Hypomyces lactifluorum</i>).....	27
Honey Mushrooms (<i>Armillaria mellea</i>).....	28
Beefsteak Mushroom (<i>Fistulina hepatica</i>).....	29
Indigo Milk Cap (<i>Lactarius indigo</i>).....	30
Coral Tooth or Comb Tooth Fungus (<i>Hericium coralloides</i>).....	31
Leatherback Mushroom (<i>Lactifluus volemus</i>).....	32
Enoki or Velvet Shank (<i>Flammulina velutipes</i> , <i>Flammulina</i> Spp.).....	33
Shrimp Mushroom (<i>Russula xerampelina</i>).....	34
Truffles.....	35
Black Truffle (<i>Tuber melanosporum</i>).....	36
Burgundy Truffle (<i>Tuber uncinatum</i>) and Summer Truffle (<i>Tuber aestivum</i>).....	37
White Truffle (<i>Tuber magnatum</i>).....	38
Record Keeping and Traceability.....	39
Training.....	39
Cultivated/Farm-Raised.....	40
Secondary Processing.....	40
Other Points of Emphasis.....	41
Model Application for Wild Mushroom Harvester.....	42
Model Application for Wild Mushroom Retailer.....	46
IFPTI Research Paper, “National Survey of State Regulation of Wild Mushroom Foraging for Retail Sale,” by Ms. Priya Nair.....	50
IFPTI Research Paper, “First National Survey of State-Level Wild Mushroom Safety Training for Retail Establishments,” by Mr. Brandon P. Morrill.....	65
References and Resources.....	77
Wild Mushroom Sub-Committee Members.....	78

Introduction

Annex 3 of the 2017 Food and Drug Administration (FDA) model Food Code states that over 5,000 species of fleshy mushrooms grow naturally in North America. The vast majority have never been tested for toxicity. It is known that about 15 species are deadly and another 60 are toxic to humans whether they are consumed raw or cooked. An additional 36 species are suspected of being poisonous, whether raw or cooked. At least 40 other species are poisonous if eaten raw, but are safe after proper cooking.

Some wild mushrooms that are extremely poisonous may be difficult to distinguish from edible species. In most parts of the country, there is at least one organization that can provide assistance with both identification and program design. Governmental agencies, universities, and mycological societies are examples of such groups.

Regulatory authorities have expressed difficulty regulating wild harvested mushrooms at retail. There are many different approaches in regulating the sale and service of wild harvested mushrooms. The differences in approach could be due to geography, the type of wild mushrooms that typically grow in a particular region, and/or local/state laws that are enforced. The Conference for Food Protection (CFP) has attempted to develop a national model or standards for regulatory programs to address and recognize wild harvested mushroom identification. The difficulty gathering consensus on national model/standards lies in the question of what is the best national model/standard available that state/local regulatory authorities can apply in a meaningful way to ensure wild harvested mushrooms sold at retail are obtained from a safe source.

With the change in the codified text, the regulatory authority will have the flexibility to apply its laws and/or policies for wild harvested mushroom identification. At a minimum, when developing a wild harvest mushroom identification program, the following elements should be addressed:

- Developing resources and criteria to select wild mushroom species for service or sale,
- Establishing record-keeping and traceability to assure safety of wild harvested mushrooms,
- Written buyer specifications that include:
 - a. Identification by the scientific name and the common name of the mushroom species,
 - b. A statement that the mushroom was identified while in the fresh state,
 - c. The name and contact information of the person who identified the mushroom and the mushroom seller, and
 - d. A statement about the qualifications and training of the identifier, specifically related to mushroom identification, and
- Development of qualifications and training curriculum that could be used for further training of mushroom identifiers.

In addition, the CFP guidance material, “Draft Model Guidance for Wild Harvested Mushrooms,” is posted on its website at <http://www.foodprotect.org> so state and local regulatory authorities can use the

information to develop and implement their own wild harvested mushroom program. The guidance document is still a work in progress.¹

Purpose of This Document

Due to increasing inquiries about the inspection process of mushrooms (either cultivated and/or wild harvested mushrooms), AFDO developed the following guidelines to assist regulatory authorities and inspection personnel in the development of a uniform statewide program. The purpose of this document is to build upon published recommendations from the Conference for Food Protection (CFP) and to give regulatory authorities a baseline for establishing a regulatory schema. As stated in the 2013 and 2017 FDA model Food Code:

3-201.16 Wild Mushrooms. (A) Except as specified in (B) of this section, mushroom species picked in the wild shall not be offered for sale or service by a FOOD ESTABLISHMENT unless the FOOD ESTABLISHMENT has been APPROVED to do so. (B) This section does not apply to: (1) Cultivated wild mushroom species that are grown, harvested, and processed in an operation that is regulated by the FOOD regulatory agency that has jurisdiction over the operation; or (2) Wild mushroom species if they are in packaged form and are the product of a FOOD PROCESSING PLANT that is regulated by the FOOD regulatory agency that has jurisdiction over the plant.

This document will attempt to provide the regulatory authority with models for approval of food establishments and harvesters in their jurisdiction while outlining some of the more common wild harvested mushrooms of culinary value that are generally not easily confused with more toxic species. This document is not intended to address cultivated mushroom production, as that farming practice is covered under the FSMA Produce Safety Rule. It is also not intended to address wild harvested mushrooms for self-consumption. Numerous books and resources are available to individuals who wish to forage for wild mushrooms for personal use.

FSMA Produce Safety Rule

Mushrooms are a covered commodity under the Standards for the Growing, Harvesting, Packing, and Holding of Produce for Human Consumption (21 CFR Part 112) Produce Safety Rule. A farm (either a primary production farm or secondary activities farm as defined in 21 CFR 1.227) can be an operation that is devoted only to the harvesting of covered produce grown in the wild. Therefore, wild foraged mushrooms are not exempt from the requirements of the Produce Safety Rule. The harvesting activity and any other covered activities conducted by the farm on covered produce are required to comply with applicable requirements in the Produce Safety Rule. The Produce Safety Rule does include some exclusions and exemptions based on farm size. FDA expects that a large proportion of operations that harvest covered produce grown in the wild may not be covered under this rule (see §112.4(a)) or may be eligible for a qualified exemption (see 21 CFR §112.5) based on their size. Note that there may also be

¹ <https://www.fda.gov/media/110822/download> (Page 467)

state or local requirements that must be met. Please also reference Comment 77 in the Federal Register Notice, Docket No. FDA-2011-N-0921, also known as the Preamble to the FSMA Produce Safety Rule.²

Model Guidance

Historically, states and local agencies have taken many different regulatory approaches for approving sources and identification experts of wild mushrooms. Some jurisdictions completely prohibit the harvest or sale. FDA and CFP recommend the following elements, at minimum, should be addressed when developing a wild harvested mushroom regulatory program:

- Developing resources and criteria to select wild mushroom species for service or sale,
- Establishing record-keeping and traceability to assure safety of wild harvested mushrooms,
- Written buyer specifications that include:
 - a. Identification by the scientific name and the common name of the mushroom species,
 - b. A statement that the mushroom was identified while in the fresh state,
 - c. The name and contact information of the person who identified the mushroom and the mushroom seller, and
 - d. A statement as to the qualifications and training of the identifier, specifically related to mushroom identification, and
- Development of qualifications and training curriculum that could be used for further training of mushroom identifiers.

Each one of these elements will be examined in the following sections. In addition, the CFP guidance document, “Guidance Document for a Model Wild-harvested Mushroom Program,” updated on 5/5/2014, is posted on their website at www.foodprotect.org. State and local regulatory authorities can use the information to develop and implement their own wild harvested mushroom regulatory programs.

Harvesting and Permits

Federal and State Land

Regulations for harvesting wild mushrooms are usually included in other state laws, along with the rules and regulations of federally managed land. In general, wild mushrooms that people plan to sell can only be harvested if they have written permission and the proper permits prior to harvesting. This includes mushrooms harvested from private landowners as well as land managed by state Departments of Natural Resources (DNRs), the United States Forest Service (USFS), Bureau of Land Management (BLM) or any other public lands. Technically, wild mushrooms are classified as forest products by DNRs and the USFS. However, the DNRs and USFS have different requirements and permits for harvesting wild mushrooms. It can be difficult to ascertain who owns private land and which agency manages public land. Therefore, it may be necessary to research land ownership to get written permission to harvest mushrooms. The county assessor or the closest U.S. Forest Service office, USDA service center, or DNR office should be able to help determine who owns and/or manages the land.

² <https://www.federalregister.gov/documents/2015/11/27/2015-28159/standards-for-the-growing-harvesting-packing-and-holding-of-produce-for-human-consumption> (Comment 77)

Native American Tribal Land

The one exception to permit requirements is wild mushrooms harvested and sold on Native American tribal lands. However, any wild mushrooms harvested on tribal land and sold on non-tribal land would be required to meet the requirements as outlined in this guidance document. The traditional way of life for many American Indian and Alaska Native and Interests Tribes involves gathering and using products from their natural surroundings. In some treaties, these rights were included under the term “gathering rights.” In negotiating treaty terms, many tribal governments reserved off-reservation rights to gather miscellaneous forest products, such as berries, roots, bark from trees, mushrooms, basket-making materials, tepee poles, cedar for totem poles, and medicinal plants.³

Wild Mushroom Species of Culinary Value

More than 1,000 species of wild mushrooms are sold as edible mushrooms around the world. More than 100 species of mushrooms are now being cultivated. More than 400 medicinal species are used by people in almost every country.⁴ Numerous species of wild mushrooms with culinary value are sought after by mushroom foragers and could make their way into commerce. Mushroom collecting is growing in popularity nationwide in a movement to discover more local food sources. Mushrooms listed in this document are the most common wild edibles. Regulatory authorities can allow the use and harvest of other species and varieties with appropriate justification.

It is important to remember that even experienced mushroom pickers can face many uncertainties during harvesting. The same mushroom looks different in the various stages of its life cycle and during very wet or very dry environmental conditions. Wild harvested mushrooms that are sold to a consumer could cause illness or death if the mushrooms haven’t been verified as safe by an individual with adequate training. The consequences of making a wrong guess or a misidentification about whether a mushroom is edible can be severe, sometimes requiring a liver transplant or even resulting in death. According to the CDC, an estimated 1,328 emergency department visits and 100 hospitalizations were associated with accidental poisonous mushroom ingestion in 2016. During 2016–2018, 8.6% (48 of 556) of patients who sought care for poisonous mushroom ingestions had a serious adverse outcome.⁵

Mystical, magical and perhaps even addictive, mushrooms are in culinary demand. The popularity of wild foraged mushrooms sold at farmer’s markets, sold at local retailers and used in food establishments is on the rise. The following species of wild mushrooms (mushrooms with tubes, spines, and ridges or other mavericks) could be considered approved by the regulatory authority because their clear identification marks make them easily identifiable in the field (fresh state) by even the novice forager.

³ <http://www.fs.fed.us/people/tribal/trib-2.pdf>

⁴ Lincoff, Gary. *The Complete Mushroom Hunter: An Illustrated Guide for Finding, Harvesting, and Enjoying Wild Mushrooms*. Quarry Books, 2010. (Page 7)

⁵ <https://www.cdc.gov/mmwr/volumes/70/wr/mm7010a1.htm>

Hen of the Woods or Maitake (*Grifola frondosa*)

Grifola frondosa is a polypore mushroom that grows in clusters at the base of hardwood trees, particularly oaks. The mushroom is commonly known among English speakers as hen-of-the-woods, ram's head, and sheep's head. It is typically found in late summer to early autumn. In the United States supplement market and in Asian grocery stores, the mushroom is known by its Japanese name, maitake (舞茸, "dancing mushroom"). Throughout Italian American communities in the northeastern United States, it is commonly known as the signorina mushroom. *G. frondosa* is a perennial fungus that often grows in the same place for a number of years in succession. It occurs most prolifically in the northeastern regions of the United States, but has been found as far west as Idaho. *G. frondosa* grows from an underground tuber-like structure known as a sclerotium, about the size of a potato. The fruiting body, occurring as large as 100 cm, is a cluster consisting of multiple grayish-brown lobes or fronds, which are often curled or spoon-shaped, with wavy margins and 2–7 cm broad. The undersurface of each cap bears about one to three pores per millimeter, with the tubes rarely deeper than 3 mm. The milky-white stipe (stalk) has a branching structure that can become tough in texture as the mushroom matures.⁶



Image credit: *Grifola frondosa* Eikhaas by Pethan 10-2004 Amelisweerd, Netherlands
(<https://commons.wikimedia.org/wiki/File:Eikhaas.JPG>)

⁶ https://en.wikipedia.org/wiki/Grifola_frondosa

Chanterelles (*Cantharellus*, *Craterellus*, *Gomphus*, and *Polyozellus*)

Chanterelle is the common name of fungi in the genus *Cantharellus*. They are among the most popular edible species of wild mushrooms. They are orange, red, yellow or white, meaty and funnel-shaped. On the lower surface, underneath the smooth cap, most species have gill-like ridges that run almost all the way down the stipe, which tapers down seamlessly from the cap. Many species emit a fruity aroma, reminiscent of apricots.⁷ Chanterelles are mycorrhizal fungi, meaning they form symbiotic associations with plants, making them very difficult to cultivate. They are common in North America and tend to grow in clusters under oaks as well as in mossy coniferous forests and even fruit trees in the subtropical regions. Chanterelles are associated with either conifers or hardwood trees, depending on species. Caution must be used when identifying chanterelles for consumption. Lookalikes, such as the Jack-O-Lantern species (*Omphalotus illudens*, *Omphalotus olearius* and others), can make a person very ill. Despite lookalike risks, chanterelles are one of the most recognized and harvested groups of edible mushrooms.⁸ Chanterelles are generally described as being rich in flavor, with a distinctive taste and aroma difficult to characterize. Some species have a fruity odor, others a more woody, earthy fragrance, and still others can be considered spicy. The golden chanterelle is perhaps the most sought-after and flavorful chanterelle, and many chefs consider it on the same short list of gourmet fungi as truffles and morels.



Image credit: Photo taken by Andreas Kunze on July 14, 2007

https://commons.wikimedia.org/wiki/File:2007-07-14_Cantharellus_cibarius_Detail.jpg

⁷ <https://en.wikipedia.org/wiki/Chanterelle>

⁸ <https://en.wikipedia.org/wiki/Cantharellus>

Golden Chanterelle (*Cantharellus cibarius*)

At one time, all yellow or golden chanterelles in western North America had been classified as *Cantharellus cibarius*. Using DNA analysis, they have since been shown to be a group of related species. In 1997, the Pacific golden chanterelle (*C. formosus*) and *C. cibarius* var. *roseocanus* were identified,⁹ followed by *C. cascadensis*¹⁰ in 2003 and *C. californicus*¹¹ in 2008.



Image credit: *Cantharellus cibarius* Chanterelle by Strobilomyces in a French wood on October 31, 2004
(https://commons.wikimedia.org/wiki/File:Chanterelle_Cantharellus_cibarius.jpg)

⁹ Redhead SA, Norvell LL, Danell E (1997). "Cantharellus formosus and the Pacific Golden Chanterelle harvest in Western North America". *Mycotaxon*. 65: 285–322.

¹⁰ Dunham SM; O'Dell TE; Molina R. (2003). "Analysis of nrDNA sequences and microsatellite allele frequencies reveals a cryptic chanterelle species *Cantharellus cascadensis* sp. nov. from the American Pacific Northwest". *Mycological Research*. 107 (10): 1163–77.

¹¹ Arora D, Dunham SM (2008). "A new, commercially valuable chanterelle species, *Cantharellus californicus* sp. nov., associated with live oak in California, USA" (PDF). *Economic Botany*. 62 (3): 376–91.

White Chanterelle (*Cantharellus subalbidus*)

Cantharellus subalbidus, the white chanterelle, is a fungus native to California and the Pacific Northwest region of North America. It is a member of the genus *Cantharellus*, along with other popular edible chanterelles. It is similar in appearance to other chanterelles, except for its cream-to-white color and orange bruising. *C. subalbidus* may form a mycorrhizal association with species of pine, hemlock, Douglas fir, and Pacific madrone. *C. subalbidus* has been found to be more common in old-growth forests than in younger forests.¹²



Image credit: This image was created by Drew Henderson (Hendre17) at Mushroom Observer (https://commons.wikimedia.org/wiki/File:Cantharellus_subalbidus_130252.jpg)

¹² https://en.wikipedia.org/wiki/Cantharellus_subalbidus

Tube Chanterelle or Yellowfoot (*Craterellus tubaeformis*)

Craterellus tubaeformis (formerly *Cantharellus tubaeformis*) is an edible fungus, also known as yellowfoot, winter mushroom, or funnel chanterelle. It is mycorrhizal, forming symbiotic associations with plants, making it nearly impossible to cultivate. *C. tubaeformis* is a yellowish-brown and trumpet-shaped mushroom found in great numbers late in the mushroom season, thus earning the common name “winter mushroom”. It is smaller than the golden chanterelle and has a dark brown cap with paler glaucous gill ridges and a hollow yellow stipe. *C. tubaeformis* tastes more earthy and less fruity than the golden chanterelle. It has a very distinctive smoky, peppery taste when raw. It grows on moss or rotten wood in temperate and cold parts of Northern America and Europe and is found both in hardwood and mixed conifer forests. It is an excellent food mushroom, especially fried or in soups, and is easily dried for preservation.¹³



Image credit: Photo taken by Jörg Hempel

(https://commons.wikimedia.org/wiki/File:Craterellus_tubaeformis_LC0374.jpg)

¹³ https://en.wikipedia.org/wiki/Craterellus_tubaeformis

Horn of Plenty (*Craterellus fallax* or *cornucopioides*)

Craterellus cornucopioides, or horn of plenty, is an edible mushroom. It is also known as the black chanterelle, black trumpet, *trompette de la mort* (French), *trombetta dei morti* (Italian) or trumpet of the dead. The mushroom is usually almost black, and it is hard to find because its dark color easily blends in with leaf litter on the forest floor. Hunters of this mushroom say it is like looking for black holes in the ground. The fruiting body does not have a separation into stalk and cap, but is shaped like a funnel expanded at the top, normally up to about 10 cm (4 in) tall and 7 cm (3 in) in diameter. However, it has been said to grow exceptionally to 15 cm (6 in). The upper and inner surface is black or dark gray, and the lower and outer fertile surface is a much lighter shade of glaucous, smoky gray, often showing noticeable streak of burnt orange rust. The fertile surface can be smooth, but may be somewhat wrinkled or veiny in appearance. This fungus is found in woods in North America, mainly growing in association with oak, but also growing with beech or other broad-leaved trees, especially in spots with moss or moist soil.¹⁴ Most hunters cannot identify *C. cornucopoides* from *C. fallax*; the former is less common and, to some noses/palates, distinctively more fragrant and flavorful. However, both are highly prized edibles and may be collected and/or served together safely.



Image credit: Photo taken by Jean-Pol GRANDMONT

(https://commons.wikimedia.org/wiki/File:Craterellus_cornucopioides.JPG1.jpg)

¹⁴ https://en.wikipedia.org/wiki/Craterellus_cornucopioides

Hedgehog Mushrooms (*Hydnum repandum*, *H. umbilicatum*, *H. albidum*, *H. albomagnum*)

Hydnum repandum, commonly known as the sweet tooth, wood hedgehog, or hedgehog mushroom, is an edible mushroom with no poisonous lookalikes. The fungus produces fruiting bodies (mushrooms) that are characterized by their spore-bearing structures — in the form of spiny tubules rather than gills — which hang down from the underside of the cap. The cap is dry, yellow to light-orange to brown in color, and often develops an irregular shape, especially when it has grown closely crowded with adjacent fruit bodies. The mushroom tissue is white, with a pleasant odor and a sweet taste. All parts of the mushroom stain light-rusty-orange with age or when bruised. A mycorrhizal fungus, *Hydnum repandum* is broadly distributed in western North America, where it fruits singly or in close groups in coniferous or deciduous woodland.¹⁵

North American lookalikes include the white hedgehog (*Hydnum albidum*) and the giant hedgehog (*Hydnum albomagnum*). The difference in size between *H. repandum* (as currently understood) and *H. umbilicatum* (as currently understood) is so great as to be troubling to many foragers; both are common and superb edibles that are often found immediately together.



Image source: Photo taken by H. Krisp

(https://commons.wikimedia.org/wiki/File:Hydnum_repandum_semmelstoppelpilz.jpg)

¹⁵ https://en.wikipedia.org/wiki/Hydnum_repandum

Common or Giant Puffball (*Calvatia gigantea*)

Calvatia gigantea, commonly known as the giant puffball, is a puffball mushroom commonly found in meadows, fields, and deciduous forests. They usually appear in late summer and autumn in temperate areas throughout the world. Most giant puffballs grow to be 10 to 50 cm (3.9 to 19.7 in.), sometimes to 90 cm (35 in.) in diameter. Occasionally, some reach diameters up to 150 cm (59 in.) and weights of 20 kilograms (44 lbs). The inside of mature giant puffballs is greenish brown, whereas the interior of immature puffballs is white. The large white mushrooms are edible when young, and only if the inside is absolutely pure white when bisected with a knife. If the inside of the mushroom shows any yellowish or greenish tinge, the entire mushroom should be discarded. The classification of this species has been revised in recent years, as the formerly recognized class *Gasteromycetes*, which included all puffballs, has been found to be polyphyletic. Some authors place the giant puffball and other members of genus *Calvatia* in order *Agaricales*. Also, the species has in the past been placed in two other genera, *Lycoperdon* and *Langermannia*. However, the current view is that the Giant Puffball is properly classified as *Calvatia*. All true puffballs are considered edible – if cooked – when immature, but can cause digestive upset if the spores have begun to form, as indicated by the color of the flesh being not pure white (first yellow, then brown).¹⁶



Image source: <https://megankerkhoff.wordpress.com/2016/09/05/giant-puffball-mushroom-steak-eggs/>

¹⁶ https://en.wikipedia.org/wiki/Calvatia_gigantea

Cauliflower Mushroom (*Sparassis crispa*)

Sparassis (also known as cauliflower mushroom) is a genus of parasitic and saprobic mushrooms characterized by a unique shape and appearance. It looks similar to a sea sponge, a brain, or a head of cauliflower (from which it takes its popular name). The best-known and most widely collected species of *Sparassis* are *S. crispa* (found in Europe and eastern North America) and *S. radicata* (found in western North America). These species have a very similar appearance and some authorities treat them as conspecific but phylogenetic analyses confirm separate species status. Their color can range from light brown-yellow to yellow-gray or a creamy white cauliflower color. They are normally 10 to 25 cm tall, but can grow to be quite large, with reported cases of fruiting bodies more than half a meter tall and 14 kg in weight. Because of their unique appearance and size, they are unlikely to be mistaken for any poisonous/inedible mushrooms. They grow as parasites or saprobes on the roots or at the bases of various species of hardwoods, especially oaks, but are also found growing among conifers, including fir, pine, or spruce trees. *Sparassis crispa* can be very tasty, but they should be thoroughly cleaned before use. The folds can contain dirt and other material as the mushroom grows and envelops objects around it, such as pine needles, bugs and even amphibians.¹⁷



Image credit: Photo taken by Jean-Pol GRANDMONT
(https://commons.wikimedia.org/wiki/File:Sparassis_crispa.JPG1.jpg)

¹⁷ <https://en.wikipedia.org/wiki/Sparassis>

Chicken of the Woods (*Laetiporus sulphureus* and *L. cincinnatus*)

Laetiporus is a genus of edible polypore fungus found throughout much of the world. Taxonomy of the various *Laetiporus* species is evolving but the edible species fall into two groups: yellow-pored and white-pored. The yellow-pored species, formerly lumped by taxonomists under *L. sulphureus*, appear on live or dead wood, usually on trunks or stumps. A single fruiting may be many feet long and may weigh upwards of 80 lbs. Yellow-pored *Laetiporus sulphureus* group specimens are commonly known as sulphur shelf, chicken-of-the-woods, the chicken mushroom, or the chicken fungus because many people think they share the taste and texture of chicken. The sulphur shelf mushroom sometimes comes back year after year on live or dead wood until its mycelium has consumed its energy source. From late spring to early autumn, the sulphur shelf thrives and may fruit repeatedly, making it a boon to mushroom hunters. It can be found days after good rain but is also often the only mushroom fruiting lushly in the driest mid- to late-summer woods. The mushroom grows in large, bracket like shelves. Individual "shelves" range from 5 cm to 25 cm (2-10 in.) across. It is most commonly found on wounds of trees, mostly oak, though some species have a preference for other trees. It is also frequently found on ash, boxelder, honey locust, eucalyptus, yew, sweet chestnut, willow, and conifers. Young, good-quality fruiting bodies are characterized by a moist, rubbery, sulphur-yellow to orange shelf-like growth, sometimes with bright orange tips, and a fresh, perfumed, fruity odor. The rule for harvesting and eating this mushroom should be the younger, the better. Texture should be succulent and meaty, but it should slice easily and the brackets should have rounded, thick outer edges. Tough, dry, and difficult-to-slice brackets should be avoided. Older shelves tend to thin out and lose their rounded edge, eventually becoming pale, brittle and almost chalk-like, mildly pungent, and often dotted with beetle or slug/woodlouse holes. Specimens that snap like chalk should be left in the woods.¹⁸

Less common but more highly prized as an edible than *L. sulphureus* is *L. cincinnatus*, the white chicken mushroom. This mushroom is similar enough to *L. sulphureus* to cause confusion but there are significant differences. *L. cincinnatus* typically arises from a tree's roots, either exposed roots or roots running below the soil so that the mushroom appears to arise from the ground itself. The pore surface of *L. cincinnatus* is bright or creamy white, while the upper surface tends to have orange or creamsicle tones, usually lacking the yellow present in a typical *L. sulphureus*. This species tends to grow in a large-lobed rosette which may weigh between 2 and 30 lbs. Additionally, unlike *L. sulphureus*, fresh *L. cincinnatus* tends to be more tender in texture and to be tender all the way to its base. Young specimens of this mushroom may have a more blob-like or irregular crestate appearance before the lobes expand into the aforementioned rosette.

Laetiporus are widely regarded as delicious and valuable as meat substitutes. Properly prepared, they have fooled many a vegetarian into thinking there is meat in a "chicken" parmesan. However, it must be noted that a small but significant subset of the human population seems to have an allergic reaction to this mushroom, which may be mild at first but increases in severity after frequent exposure. Symptoms such as a buzzing sensation on the lips and/or gastric upset after eating this mushroom signify that a person should not eat it twice. In addition, some newly described species such as *L. huronensis* may cause

¹⁸ <https://en.wikipedia.org/wiki/Laetiporus>

symptoms in more people. It is recommended that restaurants serve this mushroom with a warning about the allergy potential and avoid specimens from conifer wood. This is another fast-expanding polypore and may require careful cleaning to be free of debris it has engulfed.

Pro tip for culinary use: this mushroom tends to suck up a lot of fat in cooking. Many cooks clean, slice and soak overnight in whole milk, which penetrates the pores. The slices are then drained and cooked as usual, with the result being notably more tender and less oily.



Image source: https://en.wikipedia.org/wiki/Laetiporus#/media/File:Laetiporus_sulphureus.JPG01.jpg

Lion's Mane or Bearded Tooth (*Hericium erinaceus*, *H. americanum*, *H. abietis*)

Hericium erinaceus (also called lion's mane mushroom, bearded tooth mushroom, satyr's beard, bearded hedgehog mushroom, pom pom mushroom, or bearded tooth fungus) is an edible and medicinal mushroom. Native to North America, Europe, and Asia, it can be identified by its short, fuzzy-looking spines, its appearance on hardwoods, and its tendency to grow a single clump of dangling spines. *Hericium erinaceus* can be mistaken for other species of *Hericium*, all popular edibles which grow across the same range. In the wild, these mushrooms are common during early spring, late summer and fall on hardwoods, such as oak, maple, ash and American beech.¹⁹



Image source: https://en.wikipedia.org/wiki/Hericium_erinaceus#/media/File:Igelstachelbart,_Hericium_erinaceus.jpg

¹⁹ https://en.wikipedia.org/wiki/Hericium_erinaceus

Boletes

North America has a rather large group of edible boletes. However, identification of this group can be a very complicated, fraught endeavor. The most astute experts frequently argue over which species are which and even the most up-to-date books on these mushrooms contain information that may be conjectural at best. For purposes of this document, we will stick to characteristics that are surefire to identify a safely edible porcini mushroom and note the few dangerous and/or unpleasant-tasting ones that can ruin a whole batch or dinner. There are many, many other edible boletes but it is unlikely that any failsafe, foolproof guidelines can be developed to include them all while excluding the others.

The often-abundant Rocky Mountain version is known as *Boletus rubriceps* due to its striking reddish-brown cap. *Boletus variipes* aka “oak porcini” is widespread east of the Rockies, nearly always associated with oak. It is considered by many in the northeast, east, mid-Atlantic and Midwest to be as good as *B. edulis*-type porcini and all advice contained herein regarding *B. edulis*-type porcini holds true for *B. variipes*.

Most experienced foragers agree that good edible porcini mushrooms have only one troublesome lookalike: *Tylopilus felleus*, aka the “bitter bolete.” This mushroom often shares habitat with good *B. edulis*-type boletes and may look quite like them. However, *Tylopilus* boletes are a duller, darker brown, will have pinkish spores, and a darker brown reticulation along the stipe than a good *B. edulis*-type bolete. The fine white webbing of the good edible bolete will be absent. In addition, a quick-taste-and spit will immediately and unpleasantly confirm the incredible bitterness that is the hallmark of *Tylopilus felleus*; most tasters will immediately wish they could turn their mouth inside-out to remove the awful taste. Care and experience must be used to prevent one bitter bolete from spoiling an entire dinner. It is important that mushroom hunters are aware of their capacity to taste bitterness. To those few who lack ability to taste bitterness, *Tylopilus felleus* is an edible mushroom and is even made into a cocktail garnish.

There are only three truly poisonous porcini-type mushrooms in North America. Two of them (*Boletus satana* aka “Satan’s bolete” and *Boletus eastwoodiae*) are both found in the far western states. They have deep red pores. Although there are several exceptions to the rule, we recommend that due to the dangers posted by these two species, red-pored boletes not be served or sold in food establishments. The other dangerous bolete is *Boletus huronensis* aka “false king bolete.” This mushroom appears generally in the northeast part of the continent and is uncommon.

B. huronensis may be distinguished from good porcini by its lack of the aforementioned fine white weblike reticulation where cap meets stipe (which is universal among good *B. edulis*-type porcini) and by its slight bluish-green reaction when the pores are bruised. No good edible *B. edulis*-type mushroom will bruise blue (though there are plenty of other edible, non-*B. edulis*-type boletes that do bruise blue).

King Bolete or Porcini (*Boletus edulis*)

Boletus edulis (common name include penny bun, cep, porcino, or porcini) is a group of basidiomycete fungi including the type species of the genus *Boletus*. *B. edulis*-group mushrooms are considered some of the safest wild mushrooms to pick for the table, as no poisonous species closely resemble them. *Boletus edulis* is another European taxon that very rarely, if ever, occurs in North America. However, our native species display basically the same characteristics. These mushrooms grow in deciduous and coniferous forests and tree plantations, forming symbiotic ectomycorrhizal associations with living trees. The fungus produces spore-bearing fruit bodies above ground in summer and autumn. The fruit body has a large brown, reddish, tan, taupe or cream-colored cap that can reach 35 cm (14 in.) in diameter and 3 kg (6.6 lbs), though most specimens are smaller. It has tubes, rather than gills, extending downward from the underside of the cap. Spores escape at maturity through the tube openings, or pores. The pore surface of the *B. edulis* fruit body is whitish, cream-colored or yellow when young, but may become greenish-yellow in older specimens. The stout stipe, or stem, may be white, pale-grayish, cream-colored or a russet-yellowish in color, up to 25 cm (10 in.) tall and 10 cm (4 in.) thick, and partially covered with a raised network pattern, or reticulations. The key identifying characteristic of *B. edulis*-type mushrooms is a fine, white, weblike “netting” of reticulation where the cap meets the stipe. This characteristic is universal among “good” *B. edulis*-type mushrooms. The practice of taking a tiny nibble is also helpful in identifying good porcini mushrooms, which will always have a mild, nutty, sweet flavor with no hint of bitterness. Its spore print will be olive to olive-brown in color. Prized as an ingredient in various foods, *B. edulis*-type porcini are held in high regard in many cuisines. They are commonly prepared and eaten in soups, pasta, or risotto. The western North American species, commonly known as the California king bolete (*Boletus edulis* var. *grandedulis*) is a large, darker-colored variant first formally identified in 2007.²⁰



Image source: https://en.wikipedia.org/wiki/Boletus_edulis#/media/File:Boletus_edulis_EtgHollande_041031_091.jpg

²⁰ https://en.wikipedia.org/wiki/Boletus_edulis

Queen Bolete (*Boletus regineus*)

Boletus regineus, commonly known as the queen bolete, is an edible and highly regarded fungus that inhabits southwestern North America. It was considered a variant of the similarly edible *B. edulis* for many years, until declared a unique species in 2008.²¹ The cap is dark brown and the spongy pores underneath are white and turn dingy yellow with age. All of the basic diagnostic and identifying characteristics noted prior for the *B. edulis*-type porcini hold true for this mushroom.



Image source: https://en.wikipedia.org/wiki/Boletus_regineus#/media/File:Boletus_regineus_28082.jpg

²¹ https://en.wikipedia.org/wiki/Boletus_regineus

Matsutake (*Tricholoma matsutake*, *T. magnivelare*, *T. foucoulli*)

Matsutake (Chinese and Japanese: 松茸, Korean: 송이 (Songyi), pine mushroom, *Tricholoma matsutake* = syn. *T. nauseosum* = syn. *Armillaria ponderosa*) is the common name for a highly sought-after mycorrhizal mushroom that grows in Asia, Europe, and North America. It is prized in Japanese, Korean, and Chinese cuisine for its distinct spicy, aromatic odor. Matsutake grow under trees and are usually concealed under duff on the forest floor free of non-symbiotic trees, e.g. broad-leaved. It forms a symbiotic relationship with the roots of a limited number of tree species. *Tricholoma magnivelare* is typically called White Matsutake, as it does not feature the brown coloration of the Asian specimen. In the North American Pacific Northwest, *T. magnivelare* is found in coniferous forests made up of one or more of the following species: Douglas fir, Noble Fir, Shasta Red Fir, Sugar Pine, Ponderosa Pine, or Lodgepole Pine. In California and parts of Oregon, it is also associated with hardwoods, including Tanoak, Madrone, Rhododendron, Salal, and Manzanita. In northeastern North America, the mushroom is generally found in Jack Pine forests.²² Matsutake are very heavy, large, and stout and the characteristic odor is unmistakably strong. Though difficult to describe (often a challenging juxtaposition such as “Pine-sol and old gym socks” or “turpentine and fresh catbox”), it is never forgotten after it’s experienced. This range of odors may be faintly present in lookalikes (*Catathelasma* and *T. caligatum*) but is nowhere near as strong.



Image source: [https://en.wikipedia.org/wiki/Tricholoma_magnivelare#/media/File:2018-10-05_Tricholoma_magnivelare_\(Peck\)_Redhead_972957.jpg](https://en.wikipedia.org/wiki/Tricholoma_magnivelare#/media/File:2018-10-05_Tricholoma_magnivelare_(Peck)_Redhead_972957.jpg)

²² <https://en.wikipedia.org/wiki/Matsutake>

Wood Blewit (*Clitocybe nuda* or *Lepista nuda*)

Clitocybe nuda, commonly known as the wood blewit and alternately described as *Lepista nuda*, is an edible mushroom native to Europe and North America and found growing directly in leaf litter in both coniferous and deciduous woodlands. This mushroom can range from lilac to purple-pink. Some North American specimens are duller and tend toward tan, but they usually have purplish tones on the stem and gills. The gills are attached to the short, stout stem. Mature specimens have a darker color and flatter cap. Younger ones are lighter with more convex caps. Experienced hunters look for the in-rolled margin or edge of the cap. It is recommended that mushrooms appearing to be blewits but lacking an in-rolled margin be avoided (though a patch of blewits with both mature and young specimens may be safely harvested). Wood blewits have a very distinctive odor, which has been likened to that of frozen orange juice. It is a fairly distinctive mushroom that is widely eaten, though there is some caution about edibility. Wood blewits are generally regarded as a good edible, but they are known to cause allergic reactions in sensitive individuals. This is particularly likely if the mushroom is consumed raw, though blewits should be thoroughly cooked and not consumed raw.²³ Lookalikes include various purple-gilled *Cortinarius* species, which arise from soil and will have a base connected to that soil rather than arising from leaf litter as blewits do. Blewits will have a pale-pinkish spore print, while all purple *Cortinarius* will have a brown spore print. Inexperienced hunters or those in doubt should conduct spore-print testing each time they hunt until such doubts are resolved.



Image source: https://en.wikipedia.org/wiki/Clitocybe_nuda#/media/File:Lepista_nuda_LC0372.jpg

²³ https://en.wikipedia.org/wiki/Clitocybe_nuda

Morels (*Morchella spp.*)

Morchella, the true morels, is a genus of edible sac fungi closely related to anatomically simpler cup fungi in the order Pezizales (division Ascomycota). These distinctive fungi have a honeycomb appearance, due to the network of ridges with pits composing their cap. Morels are prized by gourmet cooks, particularly in French cuisine. Efforts to cultivate morels at a large scale have rarely been successful and the commercial morel industry relies on the harvest of wild mushrooms. Commercial harvesting of wild morels has become a multimillion-dollar industry in the temperate Northern Hemisphere, particularly North America, where these highly prized fungi are found in abundance. The fruit bodies of *Morchella* species are highly polymorphic, varying in shape, color and size, while in many cases they do not exhibit clear-cut distinguishing features microscopically. This has historically contributed to uncertainties in taxonomy. When gathering morels for the table, care must be taken to distinguish them from the poisonous "false morels," a term loosely applied to describe *Gyromitra esculenta* and other morel lookalikes.²⁴



Image source: https://www.wikiwand.com/en/Morchella_esculenta

²⁴ <https://en.wikipedia.org/wiki/Morchella>

Pearl Oyster Mushroom (*Pleurotus ostreatus*)

Pleurotus ostreatus, the oyster mushroom, is one of the more commonly sought wild edible mushrooms and is widespread in many temperate and subtropical forests throughout the world. It acts as a primary decomposer of wood, especially deciduous trees, hardwoods and pine trees. The mushroom has a broad, fan- or oyster-shaped cap spanning 5–25 cm. Natural specimens range from white to gray or tan to dark-brown; it is usually noted that “summer oysters” tend to be more white, while “fall and winter oysters” tend to have a darker gray or silvery-brown pileus. The margin is in-rolled when young, and is smooth and often somewhat lobed or wavy. The flesh is white, firm, and varies in thickness due to stipe arrangement. The gills of the mushroom are white to cream and descend on the stalk or stipelike structure. If so, the stipe is often off-center with a lateral attachment to wood. The spore print of the mushroom is white to lilac-gray, and best viewed on dark background. The mushroom's stipe is often absent and, when present, it is short and thick. The oyster mushroom is best when picked young. As the mushroom ages, the flesh becomes tough and notably bug infested and the flavor becomes acrid and unpleasant.²⁵ Oyster mushrooms are known for fruiting in most states at some point in every month of the year, including the coldest winter months.



Image source: https://en.wikipedia.org/wiki/Pleurotus#/media/File:Oyster_mushroom_fells.jpg

²⁵ https://en.wikipedia.org/wiki/Pleurotus_ostreatus

Indian Oyster Mushroom (*Pleurotus pulmonarius*)

Pleurotus pulmonarius, commonly known as the Indian Oyster, Italian Oyster, Phoenix Mushroom, or the Lung Oyster, is a mushroom very similar to *Pleurotus ostreatus*, the pearl oyster, but with a few noticeable differences. The caps of *P. pulmonarius* are much paler and smaller than *ostreatus* and develops more of a stem. *P. pulmonarius* also prefers warmer weather than *ostreatus* and will appear later in the summer. Otherwise, the taste and cultivation of the two species is generally described as largely the same. *P. pulmonarius* is widespread in temperate and subtropical forests throughout the world. In the eastern United States, this species is generally found on hardwoods. In the west, it is commonly found on conifers.²⁶



Image source: https://en.wikipedia.org/wiki/Pleurotus_pulmonarius#/media/File:Pleurotus_pulmonarius_LC0228.jpg

²⁶ https://en.wikipedia.org/wiki/Pleurotus_pulmonarius

Aspen Oyster Mushroom (*Pleurotus populinus*)

Pleurotus populinus, the aspen oyster mushroom, is a gilled fungus native to North America. It is found on dead wood of aspen and cottonwood trees (genus *Populus*). Although morphologically similar to *Pleurotus ostreatus* and *Pleurotus pulmonarius*, it has been shown to be a distinct species. Unlike *P. ostreatus*, which fruits in the autumn and winter, *P. populinus* fruits in late spring and summer. The fruit bodies have oyster shell-shaped to fan-shaped caps that are 4–19 cm (1.6–7.5 in.) broad by 4–13 cm (1.6–5.1 in.) wide. The cap margin is initially rolled inward, then becomes finely scalloped in age. The color ranges from ivory white to pinkish buff to orange-gray. The gills are somewhat decurrent, running a short way down the stipe, which is usually short to the point of barely visible. They are 3–10 mm broad, white to cream in color, and have two sets of intervening lamellulae (short gills).²⁷



Image source: https://en.wikipedia.org/wiki/Pleurotus_populinus#/media/File:Pleurotus_populinus_13996.jpg

²⁷ https://en.wikipedia.org/wiki/Pleurotus_populinus

Shaggy Mane (*Coprinus comatus*)

Coprinus comatus, the shaggy ink cap, lawyer's wig, or shaggy mane, is a common fungus often seen growing on lawns, along gravel roads, in green areas and waste areas. The young fruit bodies first appear as white cylinders emerging from the ground, then the bell-shaped caps open out. The shaggy ink cap is easily recognizable from its almost cylindrical cap, which initially covers most of its stem. The cap is mostly white with shaggy scales, which are more pale brown at the apex. The gills beneath the cap first appear white, then become pale rose-pink and then, in a process called deliquescence, turn black and secrete a black liquid filled with spores (hence the "ink cap" name). This mushroom is unusual because it will turn black and dissolve itself in a matter of hours after being picked or depositing spores and so it must be picked and processed the same day. Refrigeration can slow but not stop the deliquescence process. The young mushrooms, before the gills start to turn black, are an excellent edible provided that they are eaten soon after being collected. The only decent method of preserving shaggy manes is to cook and freeze. Dried shaggy manes are available but they lose flavor and texture. This is essentially a mushroom best consumed fresh.²⁸



Image source: [https://en.wikipedia.org/wiki/Coprinus_comatus#/media/File:Coprinus_comatus--the_Shaggy_Mane_\(32051500430\).jpg](https://en.wikipedia.org/wiki/Coprinus_comatus#/media/File:Coprinus_comatus--the_Shaggy_Mane_(32051500430).jpg)

²⁸ https://en.wikipedia.org/wiki/Coprinus_comatus

Lobster Mushroom (*Hypomyces lactifluorum*)

The Lobster mushroom, *Hypomyces lactifluorum*, contrary to its common name, is not a mushroom in the sense of other mushrooms described herein. Rather it is a parasitic ascomycete fungus called Hypomyces, a “mold” that grows on certain species of actual mushrooms, infecting their tissue and turning them a reddish orange that resembles the shell of a cooked lobster. *H. lactifluorum* specifically attacks members of the genera *Lactarius* and *Lactifluus* (milk-caps), and *Russula* (brittle-gills), such as *Russula brevipes* and *Lactifluus piperatus*. Many of these host species are so acrid they are inedible in their natural state, but the Hypomyces renders them into a choice edible. At maturity, *H. lactifluorum* thoroughly covers its host, rendering it unidentifiable. Lobster mushrooms are widely consumed and enjoyed. They are commercially marketed and are commonly found in some large grocery stores. They have a mild, sweet, rich seafood-like flavor and a firm, dense texture.²⁹



Image source: http://www.specialtyproduce.com/produce/Lobster_Mushrooms_710.php

²⁹ https://en.wikipedia.org/wiki/Hypomyces_lactifluorum

Honey Mushrooms (*Armillaria mellea*)

Armillaria mellea, commonly known as honey fungus, is a basidiomycete fungus in the genus *Armillaria*. It is a plant pathogen and part of a cryptic species complex of closely related and morphologically similar species. It causes Armillaria root rot in many plant species and produces mushrooms around the base and arising from buried roots of trees it has infected. The symptoms of infection appear in the crowns of infected trees as discolored foliage, reduced growth, dieback of the branches, and death. The mushrooms are edible, but some people may be intolerant to them. This species is capable of producing light via bioluminescence (often referred to as foxfire) in its mycelium. *Armillaria mellea* is widely distributed in temperate regions of the Northern Hemisphere. The fruit body or mushroom, commonly known as stump mushroom, stumpie, honey mushroom, pipinky, or pinky, typically grows on hardwoods but may be found around and on other living and dead wood or in open areas.³⁰ Honey Fungus are regarded in Ukraine, Russia, Poland, Germany and other European countries as one of the best wild mushrooms. However, honey fungus must be thoroughly cooked, as they are mildly poisonous raw.³¹ Most people consume only the mushroom's caps, as the stipes tend to be fibrous. It is often recommended that the caps be rinsed and/or blanched briefly in boiling water, which is then discarded, before thorough cooking. Even then, the mushroom tends to cause a laxation effect on many, especially pronounced the first time one consumes it in a season. Nevertheless, being abundant throughout many regions of North America, this mushroom is a very popular, widely consumed edible with a good flavor. There are many species of *Armillaria* and all are edible, with the aforementioned cautions. Lookalikes include various *Pluteus* and *Cortinarius* species. *Armillaria* mushrooms have a white spore print, whereas *Pluteus* spores are pinkish and *Cortinarius* are brown.



Image source: https://en.wikipedia.org/wiki/Armillaria_mellea#/media/File:Armillaria_mellea,_Honey_Fungus,_UK_1.jpg

³⁰ https://en.wikipedia.org/wiki/Armillaria_mellea

³¹ <https://en.wikipedia.org/wiki/Armillaria>

Beefsteak Mushroom (*Fistulina hepatica*)

Fistulina hepatica, also known as beefsteak polypore or ox tongue, is an unusual bracket fungus classified in the Agaricales. It is commonly seen in Britain, but can be found in North America, Australia, North Africa, Southern Africa and the rest of Europe. As its name suggests, it looks remarkably similar to a slab of raw meat. It has been used as a meat substitute and can still be found in some French markets. It has a sour, slightly acidic taste and citrus flavor. For eating, it must be collected young and it may be tough and need long cooking. The shape resembles a large tongue, and it is rough-surfaced with a reddish-brown color. The spores are released from minute pores on the creamy-white underside of the fruit body. A younger *Fistulina hepatica* is a pinkish-red color, and it darkens with age. It bleeds a dull red juice when cut, with the cut flesh further resembling meat. The underside of the fruiting body, from which the spores are ejected, is a mass of tubules. The genus name is a diminutive of the Latin word *fistula* and means "small tube," whilst the species name *hepatica* means "liver-like," referring to the consistency of the flesh. The species is fairly common, and can often be found on oaks and sweet chestnut, from August to the end of autumn, on either living or dead wood. It has a tendency to impart a reddish-brown stain to the living wood of oaks, creating a desirable timber type. It causes a brown rot on the trees which it infects.³²



Image source: https://en.wikipedia.org/wiki/Fistulina_hepatica#/media/File:Fistulina_hepatica.JPG

³² https://en.wikipedia.org/wiki/Fistulina_hepatica

Indigo Milk Cap (*Lactarius indigo*)

Lactarius indigo, commonly known as the indigo milk cap, the indigo (or blue) *Lactarius*, or the blue milk mushroom, is a species of capped fungus in the family *Russulaceae*. A widely distributed species, it grows naturally in eastern North America, East Asia, and Central America; it has also been reported in southern France. *L. indigo* grows on the ground in both deciduous and coniferous forests, where it forms mycorrhizal associations with a broad range of trees. The fruit body color ranges from dark blue in fresh specimens to pale blue-gray in older ones. The milk that oozes when the mushroom tissue is cut or broken — a feature common to all members of the genus *Lactarius* — is also indigo blue, but slowly turns green upon exposure to air. The cap has a diameter of 5 to 15 cm (2 to 6 in.), and the stem is 2 to 8 cm (0.8 to 3 in.) tall and 1 to 2.5 cm (0.4 to 1.0 in.) thick. It is an edible mushroom, and is sold in rural markets in China, Guatemala, and Mexico. Although *L. indigo* is a well-known edible species, opinions vary on its desirability. It may have a slightly bitter or peppery taste and has a coarse, grainy texture. The firm flesh is best prepared by cutting the mushroom in thin slices. The blue color turns green with cooking, and the mushroom's flesh becomes grayish. Because of the granular texture of the flesh, it does not lend itself well to drying.³³ Specimens producing copious quantities of milk may be used to add green color to marinades and it is often used in an entertaining novelty recipe for green eggs and ham.



Image source: https://en.wikipedia.org/wiki/Lactarius_indigo#/media/File:Lactarius_indigo_48568_edit.jpg

³³ https://en.wikipedia.org/wiki/Lactarius_indigo

Coral Tooth or Comb Tooth Fungus (*Hericium coralloides*)

Hericium coralloides is a saprotrophic fungus, commonly known as the coral tooth fungus. It grows on dead hardwood trees. When young, the fungus is soft and edible, but as it ages the branches and hanging spines become brittle.³⁴ *Hericium coralloides* can be found as a solitary clump or in clustered clumps on dead hardwood logs and stumps, sometimes in huge patches that can be seen from quite some distance. It is recognized by its short (mostly about 1 cm long) spines, and the spines that hang in rows along delicate branches. It is saprobic and possibly parasitic, growing alone or gregariously at summer and autumn. The fruiting body can be 8-30 cm in diameter, fleshy, white at first, light brown or yellowish with age, a few main branches arising from the narrow base, every main branch sending forth numerous smaller branches, on which dense and crowded spines hang in rows.³⁵



Image source: [https://lt.wikipedia.org/wiki/Korali%C5%A1kasis_trapiadyglis#/media/File:2009-09-25_Hericium_coralloides_\(Scop.\)_Pers_58068_crop.jpg](https://lt.wikipedia.org/wiki/Korali%C5%A1kasis_trapiadyglis#/media/File:2009-09-25_Hericium_coralloides_(Scop.)_Pers_58068_crop.jpg)

³⁴ https://en.wikipedia.org/wiki/Hericium_coralloides

³⁵ <http://www.terrain.net.nz/friends-of-te-henui-group/fungi-te-henui/fungi-icicle-tooth.html>

Leatherback Mushroom (*Lactifluus volemus*)

Lactifluus volemus, formerly known as *Lactarius volemus*, is a species of fungus in the family *Russulaceae*. It is widely distributed in the northern hemisphere, in temperate regions of Europe, North America and Asia, as well as some subtropical and tropical regions of Central America and Asia. A mycorrhizal fungus, its fruit bodies grow on the ground at the base of various species of trees from summer to autumn, either individually or in groups. The color of the *L. volemus* mushroom varies from apricot to tawny, and the cap may be up to 11 cm (4 1/2 in.) wide. The pale golden yellow gills on the underside of the cap are closely spaced and sometimes forked. One of the mushroom's most distinctive features is the large amount of latex ("milk") that it exudes when the gills are damaged, leading to the common names weeping milk cap and voluminous-latex milky. It also has a distinctive fishy smell, which does not affect the taste. It is valued as an edible mushroom, and is sold in markets in Asia. The species is considered good for novice mushroom hunters to eat. It is best prepared by slow cooking to prevent it from becoming too hard; specimens that have been rehydrated after having been dried will require longer cooking times to eliminate the grainy texture. The mushroom has also been suggested for use in casseroles and thick sauces. Pan frying is not a recommended cooking technique, due to the large amounts of latex it exudes. *L. volemus* produces a white spore print and has roughly spherical spores about 7–8 micrometers in diameter.³⁶



Image source: https://en.wikipedia.org/wiki/Lactifluus_volemus#/media/File:Lactarius_volemus_54887.jpg

³⁶ https://en.wikipedia.org/wiki/Lactifluus_volemus

Enoki or Velvet Shank (*Flammulina velutipes*, *Flammulina Spp.*)

Enoki (*Flammulina velutipes*), also known as velvet shank, is a species of edible mushroom in the family *Physalacriaceae*. It is well known for its role in Japanese cuisine, where it is also known as enokitake (榎茸, エノキタケ, Japanese pronunciation: [enoki⁺take]). The mushroom naturally grows on the stumps of the Chinese hackberry tree (*Celtis sinensis*) and on other trees, such as ash, mulberry and persimmon trees. Enoki can be sourced September- March and has been named “winter fungus” for its seasonality. Wild forms differ in color, texture, and sliminess and may be called futu, seafood mushrooms, winter mushrooms or winter fungus, velvet foot, velvet stem or velvet shank. There is a significant difference in appearance between the wild and cultivated types of the mushroom. Cultivated mushrooms have not been exposed to light, resulting in a white color, whereas wild mushrooms usually display a dark brown color. Cultivated mushrooms are grown in a carbon dioxide (CO₂)-rich environment to nurture the development of long thin stems, whereas wild mushrooms produce a much shorter and thicker stem. *Flammulina velutipes* can be distinguished by its shiny and sticky caps, white spores, and the absence of a ring on the stem. The caps range from 1–5 cm (0.39–1.97 in.). The stalks are 2–8 cm (0.79–3.15 in.) long and 4–7 mm (0.16–0.28 in.) wide. Commercially farmed enoki is a long, thin white mushroom and is a popular ingredient for soups, especially in East Asian cuisine, but can be used for salads and other dishes. The farmed *F. velutipes* is sold both fresh and canned. Wild foraged *Flammulina velutipes* is a good edible mushroom, but may have a soft or slimy texture and tough stipe.³⁷



Image source: <https://www.fungikingdom.net/fungi-photos/basidiomycota/agaricales-order-2/physalacriaceae-family/flammulina-velutipes1753.html>

³⁷ <https://en.wikipedia.org/wiki/Enokitake>

Shrimp Mushroom (*Russula xerampelina*)

Russula xerampelina, also commonly known as the crab brittlegill or the shrimp mushroom, is a basidiomycete mushroom of the brittlegill genus *Russula*. The fruiting bodies appear in coniferous woodlands in autumn in northern Europe and North America. Their caps are coloured various shades of wine-red, purple to green. *Russula xerampelina* has a characteristic odor of boiled shellfish or crab when fresh. The cap is 6–20 cm (2.5–8 in.) wide, domed, flat, or with a slightly depressed center, and sticky. The color is variable, most commonly purple to wine-red, or greenish, and darker towards the center of the cap. There are fine grooves up to a cm long running perpendicular to the margin. The gills have a mild to rather bitter taste, narrowly spaced, and turn creamy-yellow on aging specimens. The spore print is creamy-yellow to ochre. The taste of *Russula xerampelina* is mild and it is considered one of the best edible species of its genus, although the crab, or shrimp taste and smell will persist even when cooking. This is more pronounced and less pleasant in older specimens.³⁸



Image source: https://en.wikipedia.org/wiki/Russula_xerampelina#/media/File:Russula_xerampelina.jpg

³⁸ https://en.wikipedia.org/wiki/Russula_xerampelina

Truffles

A truffle is the fruiting body of a subterranean Ascomycete fungus, predominantly one of the many species of the genus *Tuber*. Truffles are ectomycorrhizal fungi and are therefore usually found in close association with the roots of several tree species, including beech, birch, hazel, hornbeam, oak, pine, and poplar. Truffles fruit throughout the year, depending on the species, and can be found buried between the leaf litter and the soil. Spore dispersal is accomplished through fungivores, animals that eat fungi. Some of the truffle species are highly prized as food. French gourmet Jean Anthelme Brillat-Savarin called truffles "the diamond of the kitchen." Edible truffles are held in high esteem in French and international haute cuisine.

Other species

A less common truffle is garlic truffle (*Tuber macrosporum*). In the U.S. Pacific Northwest, several species of truffle are harvested both recreationally and commercially. Most notable are the *Leucangium carthusianum*, "Oregon Black truffle," *Tuber gibbosum*, "Oregon spring white," and *Tuber oregonense*, the "Oregon winter white truffle." *Kalapooya Brunea*, the "Oregon Brown Truffle," has also been commercially harvested and is of culinary value. The pecan truffle (*Tuber lyonii*), syn. *Texense*, is found in the southern United States, usually associated with pecan trees.³⁹



Image source: <https://www.nationalgeographic.com/people-and-culture/food/the-plate/2016/october/the-trouble-with-truffles/#/02-trouble-with-truffles.jpg>

³⁹ https://en.wikipedia.org/wiki/Truffle#White_truffle

Black Truffle (*Tuber melanosporum*)

The black truffle or black Périgord truffle (*Tuber melanosporum*), the second-most commercially valuable species, is named after the Périgord region in France. France accounts for some 45% of the world production of black truffles. Spain and Italy account for 35% and 20% respectively. Smaller amounts are produced in Slovenia, Croatia, and the Australian states of Tasmania and Western Australia. Black truffles grow at a depth of 5 cm (2.0 in.) to 50 cm (20 in.) as ectomycorrhizae, preferably in loose calcareous soil, close to the roots of their plant symbionts. These include holm oaks, French oaks, hazel, cherry, and other deciduous trees. The round, dark brown fruiting bodies (ascocarps) have a black-brown skin with small pyramidal cusps. They have a strong, aromatic smell and normally reach a size of up to 10 cm (3.9 in.). Black truffles are harvested in late autumn and winter and are one of the most expensive edible mushrooms in the world.⁴⁰



Image source: https://en.wikipedia.org/wiki/Truffle#/media/File:Tuber_brumale_-_Vue_sur_la_tranche_coup%C3%A9e.jpg

⁴⁰ https://en.wikipedia.org/wiki/Tuber_melanosporum

Burgundy Truffle (*Tuber uncinatum*) and Summer Truffle (*Tuber aestivum*)

Burgundy truffles (designated *Tuber uncinatum*, but the same species) are harvested in autumn until December and have aromatic flesh of a darker color. Burgundy truffles have an intense, hazelnut-like aroma and are highly prized for their gastronomic qualities. They are used in the haute cuisine of France and Italy, as well as a substitute for the Périgord black truffle (*T. melanosporum*). Like other truffles, they are also canned and bottled for export. With bodies (ascocarps) from 2 cm (1 in.) to 10 cm (4 in.) in diameter, burgundy truffles are relatively large. Their brown or black outer skin (peridium) forms pyramidal warts about 3 to 9 mm wide, resembling rough bark. They have a wider distribution than any other truffle species. Burgundy truffles are found across Europe, from Spain to Eastern Europe and from Sweden to North Africa.

The black summer truffle (*Tuber aestivum*) is found across Europe and is prized for its culinary value. The flavor, size and color of summer truffles (Italian: tartufo estivo) is similar to that of burgundy truffles, but their aroma is less intense and the flesh (gleba) is a paler hazel color. As their name suggests, summer truffles are harvested earlier than burgundy truffles, from May to August. They are most often found in the southern part of the distribution area of the species, notably in the Mediterranean climate areas of France, Italy, and Spain.⁴¹



Image source: https://en.wikipedia.org/wiki/Tuber_aestivum#/media/File:Tuber_aestivum_Valnerina_018.jpg

⁴¹ https://en.wikipedia.org/wiki/Tuber_aestivum

White Truffle (*Tuber magnatum*)

The white truffle or trifola d'Alba Madonna ("Truffle of the White Madonna" in Italian) (*Tuber magnatum*) is found mainly in the Langhe and Montferrat areas of the Piedmont region in northern Italy and, most famously, in the countryside around the cities of Alba and Asti. Growing symbiotically with oak, hazel, poplar, and beech and fruiting in autumn, they can reach 12 cm (5 in.) diameter and 500 g but are usually much smaller. The flesh is pale cream or brown with white marbling. Italian white truffles are very highly esteemed and are the most valuable on the market. A variety of white truffle (*Tuber magnatum pico*) is found in other parts of northern and central Italy, but is not as aromatic as those from Piedmont.⁴²



Image source: https://en.wikipedia.org/wiki/Truffle#/media/File:Truffle_washed_and_cut.jpg

⁴² https://en.wikipedia.org/wiki/Truffle#White_truffle

Record Keeping and Traceability

1. Harvesters shall keep records with the names of the Food Establishments where wild mushrooms were sold, including dates/species/quantities. In addition, the package/container of mushrooms should have a label/tag stating the following:
 - Common name and scientific name of mushroom species,
 - Name and address (city, state, zip code) of the harvester,
 - Location/county of harvest,
 - Dates of harvest, and
 - An accurate net weight.

The intent of this requirement is to help establish record keeping and traceability to assure safety of wild harvested mushrooms.

2. Food Establishments should keep records with the name and contact information of the person who identified the mushroom and/or the mushroom seller including invoices with dates/species/quantities. The mushrooms should remain in the container in which they were received and accompanied with a record (tag/label). The records should be retained for at least 90 days from the date the container is emptied. This retention period accounts for potentially long asymptomatic latent periods (that can be up to 14 days from consumption), diagnosis and investigation timeframes that can be up to 3 weeks, and existing records-retention timeframes specified in the FDA model Food Code for other foods. Commingling of wild harvested mushroom lots is not recommended, as it serves to confound traceback or foodborne illness investigations and could hinder efforts to remove implicated product from the food chain.

Training

If/when encountering an individual who offers for sale wild mushrooms as raw, unprocessed, agricultural commodities, inspection personnel are advised to inform the individual/s of the need to have met the requirements as set forth by the regulatory authority. It is also the responsibility of the forager/harvester to provide written documentation to inspection personnel, upon demand, verifying that the wild mushroom species were examined and deemed fit for human consumption. States may also wish to develop training and certification programs in conjunction with regional mycological societies.

1. The harvester shall describe his or her qualifications and training in writing or otherwise be able to demonstrate knowledge to the regulatory authority for approval.

Cultivated/Farm-Raised

When considering whether to place a mushroom cultivator under inspection, you must first determine whether the products will be sold as raw, unprocessed agricultural commodities or as processed, finished products being offered in a consumer-size retail package.

If offered as a raw, unprocessed agricultural commodity, the business or farm will likely fall under the FSMA Produce Safety Rule (unless an exemption applies), regardless of whether the growing and cultivating takes place indoors or outdoors. An example of an outdoor growing operation would be growing shiitake mushrooms on logs. In these cases, growers typically purchase “plugs” that have previously been inoculated with fungi and insert them into holes that have been drilled into the logs. Then, as environmental conditions allow, the mushrooms begin to grow directly on the logs and are then picked by hand. When growing mushrooms in this manner, the firm should be able to provide written verification as to the origin/supplier of the mycelium or inoculated “plugs.” Indoor mushroom growing operations should be treated in the same manner when the products are being offered as raw, unprocessed, agricultural commodities. For these types of operations, the commodities will typically be offered bulk or sold at a farmer’s market in baskets or open paper bags.

If offered as processed, finished goods in retail packages, mushroom growing and processing operations should be placed under inspection by the regulatory authority. Field personnel shall use applicable laws and regulations when conducting inspections of these types of operations. Some examples of post-harvest processing by growers are washing, slicing, cutting, chopping, drying, heating, canning and/or packaging. Any type of further secondary processing would also require an inspection.

Secondary Processing

Secondary processing is best described as “after harvesting, any other type or form of manipulation of the mushroom that would alter its original physical state.” Secondary processing may include drying, dehydrating, slicing, canning, cooking or freezing. Typically, these products are then considered processed foods, sold in packages or containers, and must meet all regulatory requirements in your jurisdiction. This can include adherence to further processing regulations, such as: Federal Food, Drug, and Cosmetic Act (FD&C Act), 21CFR117 (cGMPs), 21CFR101 (Labeling), 21CFR113 (LACF), 21CFR114 (Acidified Foods), Dietary Supplement Health and Education Act of 1994 (DSHEA), the FDA Model Food Code, and all location-specific facility and licensing requirements. Generally, domestic and foreign food facilities that are required to register with section 415 of the FD&C Act must comply with the requirements for risk-based preventive controls mandated by the FDA Food Safety Modernization Act (FSMA) and the modernized Current Good Manufacturing Practices (cGMPs) of this rule (unless an exemption applies).

Other Points of Emphasis

- The regulatory authority can approve other types of wild mushrooms at their discretion, and they should obtain written documentation from the harvester.
- Beginner harvesters should avoid wild mushrooms that have caps with gills (oyster, shiitake, etc.) because they can be confused with others in the same group that are poisonous and deadly.
- Wild mushrooms can differ regionally based on climate and have deadly poisonous lookalikes.
- Wild harvested mushrooms should be thoroughly cooked (recommended temperature of 135 degrees F) and never consumed raw.
- Wild harvested mushrooms should not show any signs of spoilage (rotten, soggy, mushy, slimy, moldy) and/or insect infestation.
- Wild mushrooms that are normally edible may be dangerous, as mushrooms growing in polluted locations can accumulate pollutants, such as heavy metals, raw animal waste and pesticides.
- Mushrooms need to breathe and the packaging should have air holes or be made of a breathable material.
- Shelf-life varies between species, environmental conditions, and stage in lifecycle when harvested.
- Generally speaking, the months of harvest run from early spring to late fall.
- Any other types of wild mushroom species that are not approved by the regulatory authority and found offered for sale by field personnel would be out of compliance. As a result, they may be subject to regulatory action if found in commerce.

If field personnel encounter an operation that is not addressed in this guidance document, they should contact their Supervisor or Manager for assistance.

Wild Mushroom Harvester Application (VDACS example)



Wild Mushroom Harvester Application

(print or type)

Please provide the following information requested below and return the completed application to the Food Safety Program, ATTN: Betty Ragsdale, Virginia Department of Agriculture & Consumer Services (VDACS), Post Office Box 1163, Richmond, VA 23218-1163.

Name of Wild Mushroom Harvester: _____

Business Name: _____

Business Address: _____

County: _____

Email: _____

Telephone Number(s): (W) _____

(H) _____

(C) _____

Name and Address of Food Establishments where Wild Mushrooms Will be Sold:

2VAC5-585-320. Wild mushrooms.

A. Except as specified in subsection B of this section, mushroom species picked in the wild shall not be offered for sale or service by a food establishment unless the food establishment has been approved to do so.⁶

B. This section does not apply to:

1. Cultivated wild mushroom species that are grown, harvested, and processed in an operation that is regulated by the food regulatory agency that has jurisdiction over the operation; or
2. Wild mushroom species if they are in packaged form and are the product of a food processing plant that is regulated by the food regulatory agency that has jurisdiction over the plant.

1-25-2017

WILD HARVESTED MUSHROOMS

In Virginia, there are over 200,000 wild mushroom species of which about 200 are edible and 25 of culinary value that are normally sold. However, mushrooms picked in the wild and sold to a consumer, that haven't been verified as safe by an individual with adequate training, could result in serious illness and/or death.

The following requirements must be met for foragers/harvesters of edible wild mushrooms:

1. The harvester shall describe their qualifications and training in writing or otherwise be able to demonstrate knowledge to VDACS for approval.
2. Harvesters shall keep records with the names of the Food Establishments where wild mushrooms were sold, including dates/species/quantities. In addition the package/container of mushrooms should have a label/tag stating the following:
 - Common name and scientific name of mushroom species
 - Name and address (city, state, zip code) of the harvester
 - Location/county of harvest
 - Dates of harvest
 - An accurate net weight

Additionally, edible wild mushrooms for retail sale shall not be harvested from Federal, state, and local parks, forests and natural area preserves. The removal of edible wild mushrooms with the intent of retail sale from federal/state and/or local lands is prohibited. Individuals should contact the appropriate local or state authority responsible for management of the public lands to determine if mushroom harvesting is permissible and the permits those authorities may require. According to the VA Department of Conservation and Recreation, the picking of mushrooms for commercial use/profit is prohibited within Virginia State Parks, Natural Area Preserves and all other DCR lands.

4VAC5-30-50. Flowers, Plants, Minerals, Etc.

No person shall remove, destroy, cut down, scar, mutilate, injure, take or gather in any manner any tree, flower, fern, shrub, rock or plant, historical artifact, or mineral in any park unless a special permit has been obtained for scientific collecting.

Individuals intending to forage/harvest from someone else's property/land should obtain permission in writing from the landowner before removing any edible wild mushrooms with the intent of retail sale.

The following types of wild harvested mushrooms (mushrooms with tubes, spines and ridges and other mavericks) are considered approved by the regulatory authority (VDACS, Office of Dairy and Food, Food Safety Program) since they have clear identification marks and are easily identifiable in the field (fresh state) and there are no potentially poisonous look-a-likes:

- Hen of the Woods (*grifola frondosa*) – Japanese name is "Maitake"
- Golden Chanterelle (*cantharellus cibarius*)
- White Chanterelle (*cantharellus subalbidus*)
- Blue Chanterelle (*polyozellus multiplex*)
- Black Trumpet (*cantharellus tubaeformis*)
- Hedgehog Fungus (*hydnum repandum*, *dentinum albidum*, *dentinum repandum*, *dentinum umbilicatum*)
- Common Puffball (*lycoperdon perlatum*)
- Horn of Plenty (*craterellus cornucopioides*)
- Cauliflower Mushroom (*sparassis crispa*)
- Chicken of the Woods (*laetiporus sulphureus*)

1-25-2017

- Lion's Mane or Bear's Head or Bearded Tooth (*hericium erinaceus*)
- Various bolete species to include: Queen Bolete (*boletus aereus*), King Bolete or Cepe or Porcini (*boletus edulis*), Manzanita Bolete (*leccinum manzanitae*)
- Matsutake (*armillaria ponderosa*, *tricholoma magnivelare*)
- Blewit (*lepista nuda*)
- Morels (*morchella* spp.)
- Oyster Mushroom (*pleurotus ostreatus*)
- Shaggy Mane or Lawyer's Wig (*coprinus comatus*)
- Coral Fungi (*clavariaceae*)
- Truffles (*tuber aestivum*, *tuber magnatum*)

Other Points of Emphasis

- Mushroom caps with gills (oyster, shiitake, etc.) should be avoided by beginner harvesters because they can be confused with others in the same group that are seriously poisonous and deadly.
- Wild harvested mushrooms should be thoroughly cooked and never consumed raw.
- Wild harvested mushrooms should not show any signs of spoilage (rotten, soggy, mushy, slimy, moldy) and/or insect infestation.
- Mushrooms need to breathe and the packaging should have air holes or be made of a breathable material.
- Generally speaking the months of harvest in VA run from early spring to late fall.
- Any other types of wild mushroom species found offered for sale would be out of compliance with VDACS regulations.

The following requirements must be met for retail food establishments that sell, use or serve wild harvested mushrooms:

1. Prior to the sale of wild harvested mushrooms, food establishments shall make a request in writing by completing and submitting the "Wild Mushroom Retail Sales Application."
2. Once the application is reviewed and approved by VDACS, the food establishments shall keep records or invoices that include the following:
 - a. Name and contact information of the person who identified the mushroom and/or the mushroom seller
 - b. Common name and scientific name of mushroom species
 - c. Location/county of harvest
 - d. Dates of harvest
 - e. Date of purchase from harvester
 - f. An accurate net weight
3. The mushrooms should remain in the container in which they were received and accompanied with a tag or label.

The records shall be retained for at least 90 days from the date the container is emptied. This retention period accounts for potentially long asymptomatic latent periods (that can be up to 14 days from consumption), diagnosis and investigation timeframes that can be up to 3 weeks, and already existing record retention timeframes specified in the FDA model Food Code for other foods. Commingling of wild harvested mushroom lots is not recommended as it serves to confound traceback or foodborne illness investigations and could hinder efforts to remove implicated product from the food chain.

Species of Wild Mushrooms Establishment is requesting to sell (list all):
If species of mushroom is not listed on this document then please provide rationale for consideration of approval by VDACS on separate page.

[Redacted area]

Location(s) of harvest:

[Redacted area]

Description of qualifications and training in order to harvest wild mushrooms:

[Redacted area]

Record template for capturing all of the following (attach separate document):

- List of food establishments where mushrooms are sold
- Common name and scientific name of mushroom
- Location/county of harvest
- Date of harvest
- Date sold
- Quantity sold

Copy of the label or tag that will be available with all lots of mushrooms sold, containing all of the following (attach separate document):

- Common name and scientific name of mushroom species
- Name and address of harvester
- Location/county of harvest
- Dates of harvest
- Accurate net weight statement

I have read the application, understand the requirements, and will comply with the requirements of this document.

HARVESTER: _____ DATE: _____

(internal use only)

REVIEWED: _____ DATE: _____

Wild Mushroom Harvester Application (VDACS example)



Wild Mushroom Retail Sales Application

(print or type)

Please provide the following information requested below and return the completed application to the Food Safety Program, ATTN: Betty Ragsdale, Virginia Department of Agriculture & Consumer Services (VDACS), Post Office Box 1163, Richmond, VA 23218-1163.

Retail Food Establishment Name: _____

Retail Establishment Address: _____

County: _____

Person in Charge Name and Title: _____

Telephone Number(s): (W) _____ (H) _____ (C) _____

Email Address: _____

Name of Wild Mushroom Harvester: _____

Wild Mushroom Harvester Address: _____

Telephone Number(s): (W) _____ (H) _____ (C) _____

2VAC5-585-320. Wild mushrooms.

A. Except as specified in subsection B of this section, mushroom species picked in the wild shall not be offered for sale or service by a food establishment unless the food establishment has been approved to do so.^F

B. This section does not apply to:

1. Cultivated wild mushroom species that are grown, harvested, and processed in an operation that is regulated by the food regulatory agency that has jurisdiction over the operation; or
2. Wild mushroom species if they are in packaged form and are the product of a food processing plant that is regulated by the food regulatory agency that has jurisdiction over the plant.

1-25-2017

WILD HARVESTED MUSHROOMS

In Virginia, there are over 200,000 wild mushroom species of which about 200 are edible and 25 of culinary value that are normally sold. However, mushrooms picked in the wild and sold to a consumer that haven't been verified as safe by an individual with adequate training, could result in serious illness and/or death.

The following requirements must be met for retail food establishments that sell, use or serve wild harvested mushrooms:

1. Prior to the sale of wild harvested mushrooms, food establishments shall make a request in writing by completing and submitting the "Wild Mushroom Retail Sales Application."
2. Once the application is reviewed and approved by VDACS, the food establishments shall keep records or invoices that include the following:
 - a. Name and contact information of the person who identified the mushroom and/or the mushroom seller
 - b. Common name and scientific name of mushroom species
 - c. Location/county of harvest
 - d. Dates of harvest
 - e. Date of purchase from harvester
 - f. An accurate net weight
3. The mushrooms should remain in the container in which they were received and accompanied with a tag or label with the information above.

The records shall be retained for at least 90 days from the date the container is emptied. This retention period accounts for potentially long asymptomatic latent periods (that can be up to 14 days from consumption), diagnosis and investigation timeframes that can be up to 3 weeks, and already existing record retention timeframes specified in the FDA model Food Code for other foods. Commingling of wild harvested mushroom lots is not recommended as it serves to confound traceback or foodborne illness investigations and could hinder efforts to remove implicated product from the food chain.

The following requirements must be met for foragers/harvesters of edible wild mushrooms:

1. The harvester shall describe their qualifications and training in writing or otherwise be able to demonstrate knowledge to VDACS for approval.
2. Harvesters shall keep records with the names of the Food Establishments where wild mushrooms were sold, including dates/species/quantities. In addition the package/container of mushrooms should have a label/tag stating the following:
 - Common name and scientific name of mushroom species
 - Name and address (city, state, zip code) of the harvester
 - Location/county of harvest
 - Dates of harvest
 - An accurate net weight

Additionally, edible wild mushrooms for retail sale shall not be harvested from Federal, state, and local parks, forests and natural area preserves. The removal of edible wild mushrooms with the intent of retail sale from federal/state and/or local lands is prohibited. Individuals should contact the appropriate local or state authority responsible for management of the public lands to determine if mushroom harvesting is permissible and the permits those authorities may require. According to the VA Department of Conservation

1-25-2017

and Recreation, the picking of mushrooms for commercial use/profit is prohibited within Virginia State Parks, Natural Area Preserves and all other DCR lands.

4VAC5-30-50. Flowers, Plants, Minerals, Etc.

No person shall remove, destroy, cut down, scar, mutilate, injure, take or gather in any manner any tree, flower, fern, shrub, rock or plant, historical artifact, or mineral in any park unless a special permit has been obtained for scientific collecting.

Individuals intending to forage/harvest from someone else's property/land should obtain permission in writing from the landowner before removing any edible wild mushrooms with the intent of retail sale.

The following types of wild harvested mushrooms (mushrooms with tubes, spines and ridges and other mavericks) are considered approved by the regulatory authority (VDACS, Office of Dairy and Food, Food Safety Program) since they have clear identification marks and are easily identifiable in the field (fresh state) and there are no potentially poisonous look-a-likes:

- Hen of the Woods (*Grifola frondosa*) – Japanese name is “Maitake”
- Golden Chanterelle (*Cantharellus cibarius*)
- White Chanterelle (*Cantharellus subalbidus*)
- Blue Chanterelle (*Polyozellus multiplex*)
- Black Trumpet (*Cantharellus tubaeformis*)
- Hedgehog Fungus (*Hydnum repandum*, *Dentinum albidum*, *Dentinum repandum*, *Dentinum umbilicatum*)
- Common Puffball (*Lycoperdon perlatum*)
- Horn of Plenty (*Craterellus comucopioides*)
- Cauliflower Mushroom (*Sparassis crispa*)
- Chicken of the Woods (*Laetiporus sulphureus*)
- Lion's Mane or Bear's Head or Bearded Tooth (*Hericium erinaceus*)
- Various bolete species to include: Queen Bolete (*Boletus aereus*), King Bolete or Cepe or Porcini (*Boletus edulis*), Manzanita Bolete (*Leccinum manzanitae*)
- Matsutake (*Armillaria ponderosa*, *Tricholoma magnivelare*)
- Blewit (*Lepista nuda*)
- Morels (*Morchella* spp.)
- Oyster Mushroom (*Pleurotus ostreatus*)
- Shaggy Mane or Lawyer's Wig (*Coprinus comatus*)
- Coral Fungi (*Clavariaceae*)
- Truffles (*Tuber aestivum*, *Tuber magnatum*)

Other Points of Emphasis

- Mushroom caps with gills (oyster, shiitake, etc.) should be avoided by beginner harvesters because they can be confused with others in the same group that are poisonous and deadly.
- Wild harvested mushrooms should be thoroughly cooked and never consumed raw.
- Wild harvested mushrooms should not show any signs of spoilage (rotten, soggy, mushy, slimy, moldy) and/or insect infestation.
- Mushrooms need to breathe and the packaging should have air holes or be made of a breathable material.
- Generally speaking the months of harvest in VA run from early spring to late fall.
- Any other types of wild mushroom species found offered for sale would be out of compliance with VDACS regulations.

Species of Wild Mushrooms Establishment is requesting to sell (list all):

[Large blue rectangular area for listing mushroom species]

If species of mushroom is not listed on this document then please provide rationale for consideration of approval by VDACS:

[Large blue rectangular area for providing rationale for approval]

Record template for capturing all of the following (attach separate document):

- Name and contact information of the person who harvested or sold the mushroom
- Common name and scientific name of mushroom
- Location/county of harvest
- Date of harvest
- Date of purchase
- Quantity sold

Copy of the label or tag that will be available with all lots of mushrooms sold, containing all of the following (attach separate document):

- Common name and scientific name of mushroom species;
- Name and address of harvester
- Location/county of harvest
- Dates of harvest
- Accurate net weight statement

I have read the application, understand the requirements, and will comply with the requirements of this document.

OPERATOR: _____ DATE: _____

REVIEWED: _____ (internal use only) DATE: _____

National Survey of State Regulation of Wild Mushroom Foraging for Retail Sale

Ms. Priya Nair

Environmental Health Specialist

Georgia Department of Public Health

International Food Protection Training Institute (IFPTI)

2015 Fellow in Applied Science, Law, and Policy: Fellowship in Food Protection

Author Note

Ms. Priya Nair, Registered Environmental Health Specialist, Georgia Department of Public Health, Environmental Health Section.

This research was conducted as part of the International Food Protection Training Institute's Fellowship in Food Protection, Cohort V.

Correspondence concerning this article should be addressed to Ms. Priya Nair, Georgia Department of Public Health, 2 Peachtree Street NW, 15th Floor, Atlanta, GA 30303-3186. Email: Priya.Nair@dph.ga.gov

Abstract

An online national survey examined the regulatory approaches of 49 states toward wild foraged mushrooms intended for retail sale. A 21-question survey was sent to 50 state agencies, with 49 responses (98% response rate). The results indicated six different regulatory approaches to regulating wild foraged mushrooms at retail. These approaches include not allowing sale, identification by the state of approved wild mushroom experts certified via training, licensing of wild mushroom sellers, consumer advisory in the retail food establishment, identification of mushrooms by a wild mushroom expert with state verified credentials, or variance on a case-by-case basis. Study recommendations include the development of a guidance document by the Conference for Food Protection (CFP) and the Association of Food and Drug Officials (AFDO), increased collaboration among states to develop and share approaches for certification of wild mushroom identifiers, developing a registry and common criteria to determine qualifications of wild mushroom experts, and a comprehensive national index of edible species.

Keywords: foraged wild mushrooms, regulatory approaches, wild mushroom expert, mushroom identification, mushroom guidance resources, retail food

National Survey of State Regulation of Wild Mushroom Foraging for Retail Sale

Background

A possible result of the increasing popularity of foraging wild mushrooms has been the increase in reported cases of mushroom poisoning (Wolf-Hall, C., 2009). Most literature related to mushroom exposures and poisonings are clinical case reports, with few studies characterizing the epidemiology of exposures (Jacobs, Von Behren, & Kreutzer, 1996; Nordt, Manoguerra, & Clark, 2000; Mrvos, swanson-Biearman, & Krenzelok, 2007). Over 5,000 species of mushrooms are presumed to be found worldwide; only 20–25% have been named; and about 3% of these are poisonous (Gonmori & Yoshioka, 2003). Many of these poisonous wild mushrooms look similar in appearance to edible species of wild mushrooms. The American Association of Poison Control Centers reported 8,601 cases of mushroom poisonings in 2004 with five fatalities (Watson et al., 2005). About 80% of mushrooms involved in these cases were unidentified. An estimated guess of mushroom poisonings from foraged wild mushrooms at retail would most likely be anywhere from 10-30%, although no studies in the literature have cited any epidemiologic data. Overall, there appear to be 20-30 cultivated edible species and 15 wild edible species that are commonly collected for commercial sale and many more wild, non-commercial edibles (Kuo, 2007; Chang, 2009; Lincoff, 2010). Public health concerns related to food safety arise when commercial foragers of wild mushrooms pick toxic “look-alikes” of edible species and offer them at retail.

Limited state and local laws exist to regulate the sale of foraged wild mushrooms. Some states have followed the guidance for regulating foraged wild mushrooms based

on the U. S. Food and Drug Administration (FDA) Food Code. In Georgia, the Rules and Regulations for Food Service (Georgia Food Code Chapter 290-5-14), which is based on the 2005 FDA Food Code, states that “mushroom species picked in the wild shall be obtained from sources where each mushroom is individually inspected and found to be safe by an approved mushroom identification expert” (FDA, 2005; Georgia Department of Public Health [DPH], 2007). However, the codified text in Chapter 290-5-14 does not define who is an approved wild mushroom expert for the purpose of identifying safe species of foraged wild mushrooms. In addition, the Food Code does not clearly address traceability of foraged wild mushrooms from field to the consumers’ plate in retail food establishments. The purpose of this study was to examine the existing regulatory approaches of the state agencies that regulate foraged wild mushrooms at retail in the U.S. and to provide recommendations to states regarding the regulation of foraged wild mushrooms offered for retail sale.

Problem Statement

There is no published research in peer-reviewed food safety literature regarding regulatory approaches used by state food safety agencies related to foraged wild mushrooms at retail in the United States.

Research Questions

1. What are the existing regulatory approaches regarding foraged wild mushrooms sold at retail in the United States?
2. What resources do state food safety agencies have available for them to identify edible mushrooms that are foraged from the wild and offered at retail in the United States?

Methodology

The Association of Food and Drug Officials (AFDO) Directory of State and Local Officials (DSLO) was used to identify contacts. Initial phone calls were made to these contacts to determine which agencies are responsible for wild mushrooms at retail. A survey was then delivered by a web-based software program to the appropriate agencies. The survey consisted of 21 questions that were reviewed and revised based on input from AFDO's Wild Mushroom Subcommittee and the International Food Protection Training Institute (IFPTI). The survey asked how foraged wild mushrooms at retail were regulated, the reasons, if appropriate, for lack of regulation, the requirements for retail operators, and resources available for identification of foraged wild mushrooms. A follow-up telephone call was made to those participants who had not responded to encourage participation.

Results

Forty-nine states responded. In nine states (18%), two food safety regulatory agencies have jurisdiction (Florida, Georgia, Louisiana, Mississippi, Montana, North Carolina, South Carolina, Utah, and Virginia), and in 18 states there is no regulation (36%). Most regulation occurs in the South (39% of the 31 regulated states), followed by the Midwest (32%), the West (16%), and the Northeast (13%). Twelve (39%) of the 31 states that do regulate identified morels and chanterelles as the most common types of foraged wild mushrooms sold at retail.

Of the states which regulate, 45% use the 2009 FDA Model Food Code. The study did not find any association with the adoption of a specific version of the Food

Code by a state and its specific regulatory approach related to foraged wild mushrooms at retail. However, this study did find six distinct approaches to regulation.

1) Three states do not allow the sale or service of foraged wild mushrooms at retail as they regard foraged mushrooms as coming from an “unapproved source.” They are Delaware, Kentucky, and Louisiana.

2) Four states do allow the sale or service of foraged wild mushrooms at retail if the product was identified as safe by an “approved wild mushroom expert” — a person certified after training. Those states are Iowa, Michigan, North Carolina, and South Carolina. All of these states except for North Carolina had a state-recognized and approved training program. In Michigan, a third party provides training and certification related to wild mushroom “experts.”

3) Seven states allow the sale or service of foraged wild mushrooms at retail if the mushrooms were provided by a “licensed wild mushroom seller.” Those states are Kansas, Missouri, Montana, Nebraska, Rhode Island, Washington, and Wisconsin. The “licensed wild mushroom seller” is required in these states to ensure compliance with the regulatory requirements related to foraged wild mushrooms.

4) Only one state, Alaska, relied on consumer advisories in retail food establishments for ensuring the safety of sale or service of foraged wild mushrooms at retail.

5) Seventeen states allow the sale or service of foraged wild mushrooms at retail if they are identified by an “approved wild mushroom expert” with credentials verified by the state. Those states are Alabama, Colorado, Florida, Georgia, Indiana, Kansas, Minnesota, Missouri, New Mexico, New York, North Carolina, North Dakota, Ohio,

Oklahoma, Pennsylvania, Tennessee, Virginia, and West Virginia. In all of the states, persons who consider themselves to be a wild mushroom expert due to qualifications and experience may be reviewed by the state and may or may not be approved. Note that all of these states have no set standards for being a wild mushroom expert except for Colorado, Indiana, Kansas, Minnesota, Missouri, and Pennsylvania.

6) The respondent from one state, Utah, indicated that their state would allow the sale or service of foraged wild mushrooms in retail food establishments by use of a variance on a case-by-case basis.

Please refer to Table 1 for more information on the types of regulatory requirements for retail sale and service of foraged wild mushrooms among states who regulate foraged wild mushrooms at retail.

Table 1

Types of Regulatory Requirements for Retail Sale of Foraged Wild Mushrooms Among the 31 States Who Regulate Wild Mushrooms at Retail

Regulatory Requirements	Yes (%)	No (%)
Have restrictions to limit the volume of wild mushroom species	5 (16%)	26 (84%)
Require records to be maintained by harvester of wild mushroom species	8 (26%)	23 (74%)
Maintain a list of safe wild mushroom species	7 (23%)	24 (77%)
Maintain a list of approved wild mushroom experts	7 (23%)	24 (77%)
Have criteria for approval of wild mushroom experts	10 (32%)	21 (68%)

Table 2 identifies specific regulatory criteria that operators of retail food establishments must comply with in regards to the sale and service of foraged mushrooms at retail.

Table 2

Regulatory Requirements for Retail Operators for Sale or Service of Foraged Wild Mushrooms at Retail

Regulatory Requirements	Yes (%)	No (%)
Notify health authorities prior to selling wild mushrooms at retail	2 (6%)	29 (94%)
Inform customers of risk of consuming wild mushrooms in their establishments	2 (6%)	29 (94%)
Maintain written buyer specifications of wild mushrooms for traceability purposes	5 (16%)	26 (84%)
Purchase wild mushrooms from a permitted/licensed wild mushroom seller	5 (16%)	26 (84%)
Other	3 (10%)	28 (91%)

Note: This is among the 31 states that regulate the sale or service of foraged wild mushrooms at retail.

Only a third (10 of 31 states) reported that they have resources to identify safe and unsafe types of foraged wild mushrooms at retail in their states. Those states are Alabama, Georgia, Kansas, Michigan, Montana, North Carolina, Pennsylvania, South Carolina, Washington, and Wisconsin. Please refer to Table 3 for more information on the different types of resources used for the identification of foraged wild mushrooms.

Table 3

Types of Resources Used for Identification of Foraged Wild Mushrooms at Retail

Resources	Yes (%)	No (%)
Approved wild mushroom identifiers who have been certified through agency-recognized training.	3 (6%)	7 (70%)
An established committee that consists of food service personnel from industry, associations (mycological & restaurant), academia and commercial wild mushroom foragers	3 (30%)	7 (70%)
Extension service & academia	3 (30%)	7 (70%)
Other – another agency	1 (10%)	9 (90%)

Note: This is among those 10 states that have resources available for identification of foraged wild mushrooms at retail.

Nine states reported that they lack the resources to identify safe and unsafe mushrooms. They are Delaware, Kentucky, Louisiana, Nevada, New York, Oklahoma, Rhode Island, Virginia, and West Virginia. Three other states (Florida, Ohio, and Tennessee) did not respond to the question.

Seven states maintain a list of wild mushroom experts to serve as a reference for identification and traceability of foraged wild mushrooms. They are Colorado, Kansas, Indiana, Michigan, Missouri, Montana, and Pennsylvania. Nebraska reported that sanitarians must consult a certified mushroom individual. The respondent for Alaska indicated that the resource for identification of foraged wild mushrooms is non-applicable because they use the option of a Consumer Advisory as an approach for regulating wild mushrooms for sale or service at retail.

Some states maintain a list of safe edible species of foraged wild mushrooms that they permit for sale or service at retail in their state. Those states are Iowa, Michigan, Montana, Pennsylvania, South Carolina, Virginia, and Washington.

Conclusions

The study concluded that there is great variation in the regulation of foraged wild mushrooms. In addition to the differences in regulatory approach, almost a third of the states surveyed have more than one food safety agency involved in wild mushroom regulation which, in turn, may encourage this variation.

Another conclusion of the study is that the absence of state and national data regarding the production of foraged wild mushrooms significantly limits the ability to assess the sources of risk. For example, some states have commercial foragers picking large quantities and transporting those mushrooms across state lines.

A third conclusion is that some states are in the process of revising their regulations for food service which may increase the length of time in developing standards for foraged wild mushrooms and thus influencing the regulatory approaches in those states. Another reason for the difference in regulatory approach concerns regulatory jurisdiction. Some states have jurisdictional differences for regulating food safety at retail which may account for having more than two agencies that regulate food at retail, and this may explain the difference in inspection process for foraged wild mushrooms at retail.

Finally, some states use multiple resources to identify safe species of foraged wild mushrooms, including mycological associations, academia, and the food service industry. This multiplicity of resources suggests that there may be a need to assess the

adequacy of communication and collaboration among states and their food safety partners regarding foraged wild mushrooms.

Recommendations

Four recommendations are suggested below given the great variation in regulation as well as the lack of national data and generally accepted best practices.

A Conference for Food Protection (CFP) and Association of Food and Drug Officials (AFDO) guidance document should be developed regarding the regulation of foraged wild mushrooms for sale or service at retail. A guidance document is clearly the single most important step forward given the great variety in regulation and a strong national demand for wild mushrooms.

States should collaborate and partner with other states and industry to recognize certification programs for approved wild mushroom identifiers. Given that mushrooms tend to be regional in nature due to geography and climate, states are likely to achieve economies of scale due to joint action in regulation.

All states might consider developing common criteria to determine qualifications for the approval of wild mushroom experts and creating a registry of approved wild mushroom experts.

All states should maintain a list of safe edible species of foraged wild mushrooms for reference purposes. This is clearly a simple step forward and one that appears of immediate use.

Acknowledgements

Thank you to Dr. Chris Rustin, Environmental Health Section Director; Chris Kumnick, Environmental Health Section Deputy Director; my supervisor, Cameron Wiggins, Food Service Program Director; and all of my work colleagues at the Department of Public Health (DPH) for supporting this endeavor. Thank you to my mentor, Ms. Charlene Bruce, who guided me throughout the entire project. I would like to thank Dr. Paul Dezendorf, mentors, and other subject matter experts of the IFPTI Fellowship for their guidance with the project. I would also like to thank Erik Bungo, AFDO Wild Mushroom Subcommittee, and Dr. Francis Annor for their additional support, which was greatly appreciated. A big thank you to all of the Fellows who participated in Cohort V. It has been an amazing learning opportunity and a rewarding experience. Finally, I would like to thank my husband, Anil, for his continued support in my professional endeavors.

References

- Broussard, C. N., Aggarwal, A., Lacey, S. R., Post, A. B., Gramlich, T., Henderson, J. M., & Younossi, Z. M. (2001). Mushroom poisoning – from diarrhea to liver transplantation. *Am J Gastroenterol*, 96(11), 3195–3198.
- Chang, S. T. (2009). *Training manual on mushroom cultivation technology*. Beijing, China: United Nations Asian and Pacific Centre for Agricultural Engineering and Machinery (APCAEM). Retrieved from <http://www.un-csam.org/publication/tm-mushroom.pdf>
- Conference for Food Protection. (2014). *Guidance document for a model wild-harvested mushroom program*. Retrieved from <http://www.foodprotect.org/guides-documents/guidance-document-for-a-model-wild-harvested-mushroom-program/>
- Diaz, J. H. (2005, February). Evolving global epidemiology, syndromic classification, general management, and prevention of unknown mushroom poisonings. *Crit Care Med*, 33, 419-426.
- Georgia Department of Public Health. (2007). *Rules and Regulations for Food Service* (Georgia Food Code Chapter 290-5-14). Atlanta, GA: Georgia Department of Public Health.
- Gonmori, K. & Yoshioka, N. (2003, March). The examination of mushroom poisonings at Akita University. *Leg Med (Tokyo)*, 5(Suppl 1), S83–S86.
- Jacobs, J., Von Behren, J., & Kreutzer, R. (1996). Serious mushroom poisonings in California requiring hospital admission, 1990 through 1994. *West J Med*, 165(5), 283-288.

- Klein, A. S., Hart, J., Brems, J. J., Goldstein, L., Lewin, K., & Busuttil, R. W. (1989, February). Amanita poisoning: Treatment and the role of liver transplantation. *Am J Med*, 86(2), 187-193.
- Kuo M. (2007). *100 wild edible mushrooms*. Ann Arbor, MI: University of Michigan Press.
- Lincoff, G. (2010). *The complete mushroom hunter: an illustrated guide to finding, harvesting, and enjoying wild mushrooms*. Minneapolis, MN: Quarry Books.
- Mrvos, R., Swanson-Biearman, B., & Krenzelok, E. P. (2007). Backyard mushroom ingestions: No gastrointestinal decontamination—no effect. *J Emerg Med* 33(4), 381-383.
- Nordt, S. P., Manoguerra, A., & Clark, R. F. (2000). 5-year analysis of mushroom exposures in California. *West J Med*, 173(5), 314-317.
- U. S. Food and Drug Administration. (2005). *Food Code 2005*. Retrieved from <http://www.fda.gov/Food/GuidanceRegulation/RetailFoodProtection/FoodCode/ucm2016793.htm>
- U. S. Food and Drug Administration. (2012). *Bad bug book: Foodborne pathogenic microorganisms and natural toxins handbook*. Retrieved from <http://www.fda.gov/downloads/Food/FoodborneIllnessContaminants/UCM297627.pdf>
- Watson, W. A., Litovitz, T. L., Rodgers, Jr., G.C., Klein-Schwartz, W., Reid, N., Youniss, J....Wruk, K. M. (2004). 2004 Annual report of the American Association of Poison Control Centers Toxic Exposure Surveillance System. *The American Journal of Emergency Medicine*, 23(5), 589-666.

Wolf-Hall, C. (2009). Fungal and Mushroom Toxins. In V. Juneja & J. Sofos (Eds.),
Pathogens and toxins in foods: Challenges and interventions (pp. 275-285).

Washington, DC: ASM Press.

Yardan, T., Baydin, A., Eden, A. O., Akdemir, H. U., Aygun, D., Acar, E., & Arslan, B. (2010). Wild mushroom poisonings in the Middle Black Sea region in Turkey: Analyses of 6 years. *Hum Exp Toxicol*, 29(9), 767-7

First National Survey of State-Level Wild Mushroom Safety Training
for Retail Establishments

Brandon P. Morrill

Sanitarian

Health Department of Northwest Michigan

International Food Protection Training Institute (IFPTI)

2015 Fellow in Applied Science, Law, and Policy: Fellowship in Food Protection

Author Note

Brandon Morrill, Sanitarian, Health Department of Northwest Michigan,
Environmental Health.

This research was conducted as part of the International Food Protection
Training Institute's Fellowship in Food Protection, Cohort V.

Correspondence concerning this article should be addressed to Brandon Morrill,
Health Department of Northwest Michigan, 220 W. Garfield, Charlevoix, MI 49720.

Email: b.morrill@nwhealth.org

Abstract

This first national survey of the food safety training and requirements regulating the use of wild foraged mushrooms in retail establishments compared 49 states to Michigan's new training and standards using telephone interviews during the fall of 2015. In 2014, the Michigan Department of Agriculture and Rural Development, in collaboration with non-profit partners, created a "mushroom broker" certification that defined "approved sources" and the training required to be a "wild mushroom expert." This survey was designed to place the Michigan training in a national context. The survey found limited common ground regarding definitions and regulations among the states. While 26 states perceived wild mushroom foraging as an increasing food safety risk, only 28 states had formal or informal partnerships with relevant non-profits or academic institutions to address mushroom harvesting and only four states provided training for either inspectors or harvesters. The study concluded that current food safety regulation is rudimentary, fragmented, and lags behind the increasing use and associated risk of wild mushrooms. The study recommends adoption of an Association of Food and Drug Officials (AFDO) guidance document and increased state efforts to seek ideas and models for regulation from other states to identify possible resources within their own borders for training, such as the use of academic centers or non-profit organizations.

Keywords: wild foraged mushrooms, wild mushroom expert, AFDO, safety training, retail food

First National Survey of Wild Mushroom Safety Training for Retail Establishments

Background

Commercial mushroom production in the U.S. is increasing in terms of the value of sales, which reached \$1.12 billion in 2014 (U. S. Department of Agriculture [USDA], 2014). Factors influencing food choices — such as farm- or harvest-to-fork marketing, an increase in imported food products, increased immigration, and consumer willingness to try new foods — are contributing to commercial mushroom production. This has in turn increased the interest in foraging and harvesting of wild mushrooms.

In response to the increased use of wild mushrooms, the U. S. Food and Drug Administration's (FDA's) 2009 Food Code in §3-201.16 Wild Mushrooms required that the product being foraged or harvested be done so by an “approved mushroom identification expert” (U. S. Food and Drug Administration [FDA], 2009). Following the adoption of the 2009 Food Code, the Conference for Food Protection (CFP) recommended that additional requirements be added — similar to shellstock tags with shellfish — to allow traceback in the event of a foodborne illness. The CFP also recommended creation of a national guidance document. In turn, the Association of Food and Drug Officials (AFDO) in 2014 convened an ad hoc Wild Mushroom Subcommittee in response to the perceived increase in risk. That Subcommittee was tasked with drafting a national guidance document for AFDO review by the end of 2016.

There is limited epidemiological information regarding mushroom exposures due to a lack of national surveillance data (Kintziger et al., 2011). For example, in Michigan the state Poison Control Center has tracked an average of 370 cases per year since 2004, but no data is available regarding the number of cases involved in retail sale or

consumption. However, the increased demand for wild mushrooms along with the perception of increased risk led the Michigan Department of Agriculture and Rural Development (MDARD) to establish a set of standard requirements that defines a “wild mushroom expert” and to specify the species approved for sale with the help of Midwest American Mycological Information (MAMI), the Michigan Farmers Market Association (MIFMA), and the Institute for Sustainable Living, Art, and Natural Design (ISLAND). These groups also developed a training program including hands-on exercises and written examinations. Most participants to date have been mushroom brokers and market managers. The all-day class provided by MAMI costs \$175. If participants pass the exam, they are recognized by MDARD as a “wild mushroom expert” for a period of five years. MDARD is in the final stages of adopting guidelines regarding the wild mushroom competency of local and state inspectors. These standards and practices will include guidance regarding the use of foraged wild mushrooms in the retail setting, both farmers markets and food service, in addition to the best practices for storing and labeling.

As Michigan was developing an approach focused on training, the FDA’s 2013 Food Code was released. The 2013 Code shifted focus from mushroom identification experts to approving individual food establishments to sell wild foraged mushrooms (FDA, 2013, 2014). Given the changes in the Food Code and the increased concern with retail mushroom sales, regulators in Michigan sought to better understand how wild mushroom food safety regulation was being carried out across the nation. They examined the number of foodborne illnesses related to mushrooms in a retail setting,

specific mushroom training, barriers and challenges to training, resources for regulators, and statewide directives regarding wild mushroom certification.

Problem Statement

At present, there is no national overview of training for food safety regulation regarding wild mushrooms foraged for retail sale or consumption.

Research Questions

1. What wild mushroom training is available to regulatory officials?
2. What are the barriers and challenges to providing wild mushroom training to regulatory officials?
3. What are the resources available for developing wild mushroom training for regulators?

Methodology

A telephone survey was conducted with all 50 states and the District of Columbia. Respondents were identified from the Directory of State and Local Officials (DSLO) (Association of Food and Drug Officials [AFDO], 2015) whose responsibilities included retail food. The survey consisted of nine questions. The first two questions identified level of management and knowledge. The remainder of the questions quantified the respondent's experiences with wild mushrooms, training available to them or their staff, and resources available for developing and maintaining training. The survey was conducted between November 1, 2015 and March 18, 2016. All respondents received an informed consent notice by email, along with the questions, in advance of the interview.

Results

Twenty-nine states and the District of Columbia responded to the initial telephone call (56.8%). Multiple attempts were required to obtain a complete national survey. All respondents described their position in the agency or department as supervisor, manager, or executive and all were located in state departments such as Agriculture, Health, or other agency. Most respondents had responsibility over food protection in the retail setting, and a few had policy responsibility.

The difficulty in obtaining responses from roughly half of the states was associated with a lack of familiarity with wild mushroom safety. In fact, respondents — who had responsibility in their state for retail food protection — considered their knowledge of wild mushrooms as either “basic” or “nonexistent.” Only 28 respondents could identify a local association or academic organization with expertise in wild mushrooms as an actual or potential resource. Only eight had an identification expert. Two relied on reference books, and eight were dependent on the Internet for their knowledge. On the other hand, 26 respondents perceived wild mushroom foraging as presenting an increasing food safety risk to the public and almost every respondent stated that they would like to improve their knowledge of this area.

Another difficulty in obtaining a national picture of wild mushroom training is the lack of standardization as illustrated by Table 1. Ten states allowed wild mushroom harvesting under the 2009 and prior versions of the Food Code. Those who were using the current (2013) version of the Food Code did not allow for wild mushroom harvesting. Previous versions of the Food Code, 2009 and prior, placed the responsibility of defining “approved mushroom expert” on the State. The current Food Code (2013), §3-

201.16, simply states the food establishment must be approved in order to sell wild foraged mushrooms.

Table 1

States approach to Wild Mushroom Use in Retail

Food Code	Regulation	Provide training	No training	Total
2009/prior Food Codes	Mushroom expert required for retail	MCAFD0 [IA, MO] NCAFD0 [IN, MN, MI] WAFD0 [WA]	AFDOSS [KY, GA] CASA [MD, WV, VA] MCAFD0 [KA, AR] NCAFD0 [IL, ND, WI] NEFD0A [ME, NY] WAFD0 [AK, AZ, HI, ID, NV, OR, WY]	25
	No wild mushrooms allowed		AFDOSS [AL, FL, NC, LA, TN] CASA [OH, NJ] NCAFD0 [SD] NEFD0A [CT, RI, NH, VT] WAFD0 [UT, OR]	14
	All adopted	AFDOSS [SC]	AFDOSS [MS] WAFD0 [CO]	3
2013 Food Code	Mushroom harvesting not included		AFDOSS [TX] NCAFD0 [DC] CASA [DE, PA] WAFD0 [MT, NM, UT]	7

Legend: The Association of Food and Drug Officials of the Southern States (AFDOSS), Central Atlantic States Association of Food and Drug Officials (CASA), Mid-Continental Association of Food and Drug Officials (MCAFD0), North Central Association of Food and Drug Officials (NCAFD0), Northeast Food and Drug Officials Association (NEFD0A), and the Western Association of Food and Drug Officials (WAFD0).

Only one state, Michigan, offered training to retail operators and only six states offered training to inspectors. In each, the training was developed in partnership with local non-profits that specialized in mushroom-related activities and with universities. The remaining states cited the lack of standardization or course availability as the main barrier to the training (eight states) and the second-most cited reason was the lack of a demand for training (seven states). Those respondents who cited no demand were located in regions uncondusive to mushroom growth. The third-most cited reason (five

states) was they did not view wild foraged mushrooms as an approved source of mushrooms.

Table 2

Typical Responses to Survey Questions

Is specific training available to your agency/department?	What are the barriers/challenges that are preventing training?	What other resources are available?
No (<i>n</i> =42)	Lack of standards	Local land grant university
No, not an issue	Not an approved source	Internet
Yes, non-profit group	Budget constraints	Local expert

Conclusion

The study found that training for regulatory officials regarding retail sale or consumption of wild mushrooms is extremely limited. Most states are only now becoming aware of the extent of foodborne illness risks associated with wild mushrooms.

One possible reason for the low level of knowledge and lack of resources devoted to mushroom safety is the lack of publicized mushroom poisoning incidents. For example, only two respondents could identify a foodborne illness resulting from retail sale or service of wild mushrooms. Another reason is that epidemiological tracking of mushroom incidents at retail is either limited or nonexistent throughout the country. Another possible contributing factor is a low level of senior management interest; only seven of the respondents could identify a statewide directive or memo of any type issued by senior agency officials regarding wild mushrooms.

The barriers and challenges to implementing training begin with the lack of national uniformity regarding wild mushroom regulation. Another concern in many states

is potential liability related to allowing wild mushroom sales. In these states, there appears to be a “zero tolerance” approach to wild mushroom foraging. Another barrier occurs when states define “approved source” and “wild mushroom expert” in order to relieve themselves of the training requirement for regulators, which mirrors a concern brought forth by the CFP.

Most states had not sought assistance in dealing with wild mushrooms, despite the evidence of resources for designing and implementing training available from major universities, non-profits who work to educate the public on mushroom safety, and other sources.

Recommendations

States should support AFDO’s effort, supported by other organizations, to create a national guidance document in order to foster a more proactive and uniform regulatory approach to wild mushroom use at retail.

States should also seek out and identify possible approaches to addressing mushroom safety by examining efforts in other states. For example, Michigan pioneered the use of a collaborative approach involving a multi-stakeholder working group. Other approaches might include a multi-state working group, an initiative based at a land-grant university, and a convening of stakeholders by the Partnership for Food Protection.

States should work with those in their AFDO region and neighboring states as climate and geography encourage growth of certain types of mushrooms in specific regions that encompass multiple states. In addition, the specialized nature of mushroom identification lends itself to those neighboring states pooling resources for training.

Acknowledgements

I would like to thank Mike Jones and Scott Kendierski of the Health Department of Northwest Michigan for their encouragement, as well as Erik Bungo and the whole AFDO Wild Mushroom Subcommittee. Many thanks to the other Fellows of Cohort V and the entire staff of the International Food Protection Training Institute for the opportunity to participate in this Fellowship Program. I would also like to thank Dr. Paul Dezendorf for guidance and input throughout the Fellowship and my mentor Charlene Bruce for her constant encouragement. Last, but surely not least, I thank all the participants for their contributions to this research and their patience with me on the telephone.

References

Association of Food and Drug Officials. (2015). *Directory of State and Local Officials*.

Retrieved from <http://dslo.afdo.org/>

Conference for Food Protection. *Guidance document for a model wild-harvested mushroom program*. (2014). Retrieved from <http://www.foodprotect.org/guides-documents/guidance-document-for-a-model-wild-harvested-mushroom-program/>

Kintziger, K. W., Mulay, P., Watkins, S., Schauben, J., Weisman, R., Lewis-Younger, C., & Blackmore, C. (2011). Wild mushroom exposures in Florida, 2003–2007. *Public Health Reports*, 126(6), 844–852.

Michigan Regional Poison Control System. (2016). *Michigan Regional Poison Control System patient statistics, 2004-2014: Wild mushroom poisoning data*.

U. S. Department of Agriculture. (2014). *Mushrooms*. Retrieved from

http://www.nass.usda.gov/Statistics_by_State/Wisconsin/Publications/Crops/2014/US_Mush-08-20-2014.pdf

U. S. Food and Drug Administration. (2009). *FDA Food Code 2009: chapter 3*.

Retrieved from

<http://www.fda.gov/Food/GuidanceRegulation/RetailFoodProtection/FoodCode/ucm186451.htm>

U. S. Food and Drug Administration. (2013). *Food Code 2013*. Retrieved from

<http://www.fda.gov/Food/GuidanceRegulation/RetailFoodProtection/FoodCode/ucm374275.htm>

U. S. Food and Drug Administration. (2014). *Summary of changes in the FDA Food Code 2013*. Retrieved from

<http://www.fda.gov/Food/GuidanceRegulation/RetailFoodProtection/FoodCode/ucm374759.htm>

References and Resources

- Schwab, Alexander. *Mushrooming Without Fear: The Beginner's Guide to Collecting Safe and Delicious Mushrooms*. Skyhorse Publishing Inc., 1996.
- Lincoff, Gary. *The Complete Mushroom Hunter: An Illustrated Guide for Finding, Harvesting, and Enjoying Wild Mushrooms*. Quarry Books, 2010.
- Kuo, Michael. *100 Edible Mushrooms*. The University of Michigan Press, 2007.
- Jordan, Peter. *Mushroom Picker's Foolproof Field Guide*. Hermes House, an imprint of Anness Publishing Limited, 2010.
- National Audubon Society. *Field Guide to Mushrooms of North America*. Chanticleer Press Inc., 1981.
- National Audubon Society. *Field Guide to Trees of Eastern Region North America*. Chanticleer Press Inc., 1980.
- WSDA *Handbook for Small and Direct Marketing Farms*, 2014. Pages 136-139. <http://agr.wa.gov/Marketing/SmallFarm/Greenbook/docs/32.pdf>
- Dr. Kathy Hodge, Cornell University
- North American Mycological Association (NAMA) www.namyco.org
- The American Mushroom Institute (AMI) www.americanmushroom.org
- The International Mycological Association (IMA) www.ima-mycology.org
- National Sustainable Agriculture Information Service (ATTRA) www.attra.ncat.org
- Midwest American Mycological Information (MAMI) <http://www.midwestmycology.org/Index.html>
- International Food Protection Training Institute (IFPTI) <https://ifpti.org/>
- Tribal Lands <http://www.fs.fed.us/people/tribal/trib-2.pdf>

AFDO Wild Mushroom Sub-Committee

Erik Bungo (Chair), Virginia Department of Agriculture and Consumer Services, Produce Safety Program Supervisor

Mark (Mick) Miklos, National Restaurant Association, Program Director, Member Engagement

Byron Beerbower, FDA - U.S. Food and Drug Administration, Consumer Safety Officer

Sandra Walker, Michigan Department of Agriculture and Rural Development, Food Section Manager

Tressa Madden, FDA -U.S. Food and Drug Administration, Consumer Safety Officer

Valerie Gamble, Minnesota Department of Agriculture

Brandon Morrill, Health Department of Northwest Michigan, Sanitarian

Priya Nair, Georgia Department of Public Health, Environmental Health Specialist

Terri Gerhardt, Ohio Department of Agriculture, Division of Food Safety, Chief

Phyllis Black, New York Department of Agriculture & Markets, Supervising Food Inspector

Stephen Russell, The Hoosier Mushroom Society

John Sanders, DHS - U.S. Department of Homeland Security, Veterinary Medical Officer

Joseph Goetz, C & S Wholesale Grocers Inc., Director of Food Safety & Regulatory Compliance

David W. O'Guinn, Oregon Department of Agriculture, Retired

Alice Campbell, Northeast Tri County Health District in Washington State, Environmental Health Specialist II

Special thanks to Mr. Bruch Reed and his colleagues at the North American Mycological Association for peer review.

For additional copies of this document please contact:

AFDO
155 W. Market St., 3rd Floor
York, PA 17401
717-757-2888 (phone)
717-650-3650 (fax)
afdo@afdo.org
www.afdo.org