

Kansai University Term Report
Class: 2022-Fall Japanese Society (Friday, 3rd class, Class ID: 00708)
Teacher: ヒートン ジェニーン
Student ID: ES22-5040
Name : YANG YU HSIANG(ヤンユーシアン)
2022/11/11(Friday)

Title :

Risky dining in Japanese society: Should we eat pufferfish?

1. Introduction:

Have you ever eaten puffer fish? Pufferfish has been seen as poisonous fish and was proposed to be banned from human dining table in some research due to several intoxication cases and even death. However, somewhere on earth, the consumption of puffer fish remains popular for tourism and local dining tables mainly in Japan.

To understand the issue of the puffer fish eating in Japan more clearly, this article dig in more deeply to under the puffer fish as a living creature and how they have been captured and eventually show up on human's dining table. Consequently, there is some research questions needed to be answered.

The first serial question, what is puffer fish? Are all kinds of puffer fish is poisonous? What kinds of puffer fish are poisonous? The second serial question, how puffer fish eating culture occurred in the world and Japan? How did the society accept the concept of eating puffer fish? The third serial questions is, Should we eat puffer fish? With these three serial questions, hopefully, we can understand the Japan society in the dining aspect from an interesting perspective.

2. Research Question:

As proposed in the introduction chapter, there are three main research questions in this article. The research questions were listed in a more compact method as the following:

1. Which puffer fish is poisonous?
2. How did puffer fish eating culture form?
3. Should we eat puffer fish?

3. Result:

3.1 Which puffer fish is poisonous?

Pufferfish is widely distributed all over the world from the western culture zone to

the oriental culture zone. Even in a famous cartoon, “sponge bob square pant”, the puffer fish get a character as a coach in driving school. Puffer fish is a vertebrate animal (脊椎動物 (せきつどうぶつ)) belonging to the class Actinopterygii (条鰓類 (じょうきるい)) , including ray-finned fishes. Below class Actinopterygii, puffer fishes are classified as Tetraodontiformes(四齒目(しはめ)), which is the order that includes the following 9 subgroups: Balistidae (triggerfishes), Diodontidae (porcupinefishes), Molidae (molas), Monacanthidae (filefishes), Ostraciidae (boxfishes), Tetraodontidae (puffer fishes), Triacanthidae (triplespines), Triacanthodidae (spikefishes), and Tridontidae (three-toothed puffers).

The families Diodontidae, Tetraodontidae, and Tridontidae (185 species in 28 genera) include poisonous puffer fish, also known as tetrodotoxin fish. Tetrodotoxin is a toxic chemistry material, whose chemical sign is $C_{11}H_{17}N_3O_8$, this kind of toxin might cause human death above a certain amount of potion.



Figure 1 Photographs of puffer fish, LAGOCEPHALUS SCELERATUS, Source:

Table 1 Characteristics of puffer fishes in the families of Diodontidae, Tetradontidae and Tridontidae.(Draw by YANG YU HSIANG, 2022, refer to the figure in)

Family	Characteristic	Illustration
Diodontidae (2-toothed puffers)	<ol style="list-style-type: none"> 1. Sharp spines cover skin. 2. Jaws with 2 fused teeth 3. Oppsite premaxillaries 	

<p>Triodontidae (3-toothed puffers)</p>	<p>1. Jaws bearing 3 fused teeth. 2. Exist Pelvis.</p>	 <p>3 teeth</p> <p>Triodontidae</p>
<p>Tetradontidae (4-toothed puffers)</p>	<p>1. Naked or short prickles in belly. 2. Jaws bearing 4 teeth.</p>	 <p>4 teeth</p> <p>Tetradontidae</p>

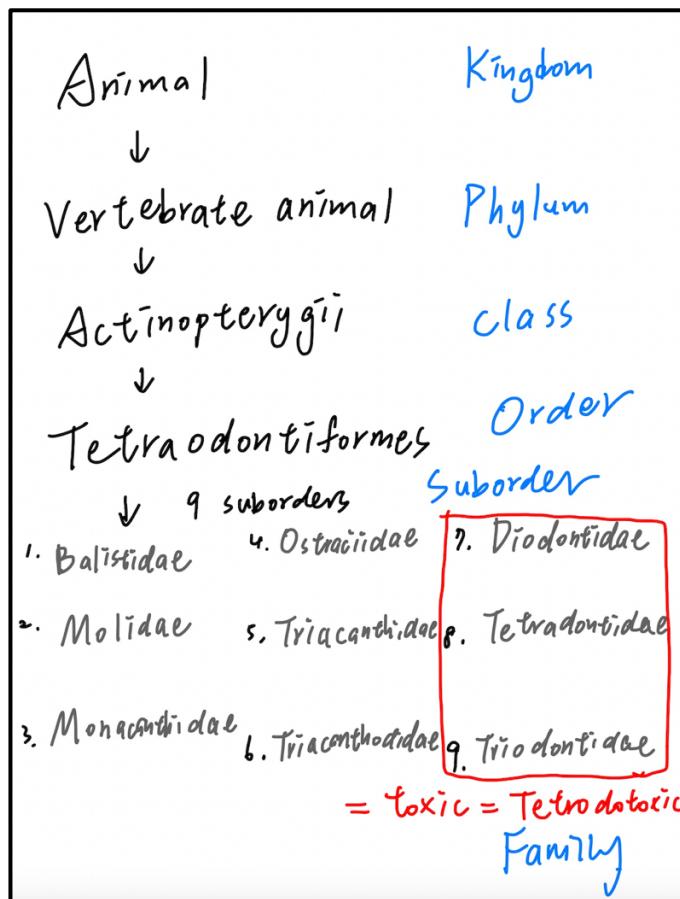


Figure 2 Family tree of puffer fish

Why eating puffer fish is risky?

Puffer fish is typically consumed in Japan, where it is a conventional fish meat and considered a high-end cuisine, even though it contains the potent neurotoxin tetrodotoxin(TTX, in Japanese language, テトロドトキシン), produced by ocean bacteria, which spreads via good chains. TTX is not only found in puffer fish but also

in other marine animals including Japanese gastropods.

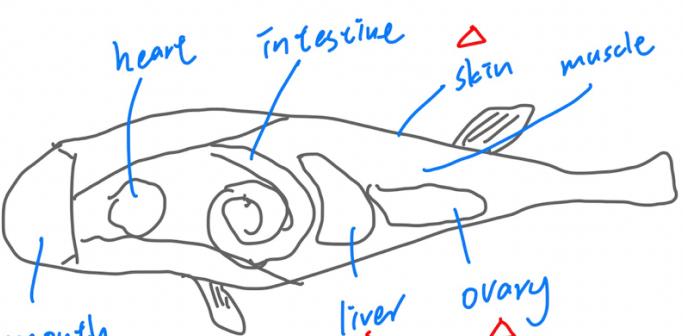
The first reported puffer-fish-eating related poisoning was published in 1959 by the Japanese Ministry of Health and Wellness. After this government report, puffer fish processing was largely improved and now, puffer fish can be safely consumed if it is properly prepared to ensure the absence of toxins. However, the consumption of puffer fish remains risky in cases of improper processing, illegal sales, mixing puffer fish with other fish to make fish fillets and so on.

Puffer fish were first reported in 1914. At that time, puffer fish was not deemed as commercially valuable and not extensively studied. With more and more research after the earliest report of puffer fish, one significant research found not all puffer fish contained toxin(in puffer fish cases, TTX). 23 species were inspected and found two of which contained no toxic tissue. The toxicity levels of puffer fish can be classified into the following 4 groups:

1. less than 10 MU/g, nontoxic;
2. 10–100 MU/g, slightly toxic;
3. 100–1000 MU/g, moderately toxic;
4. above 1000 MU/g, extremely toxic.

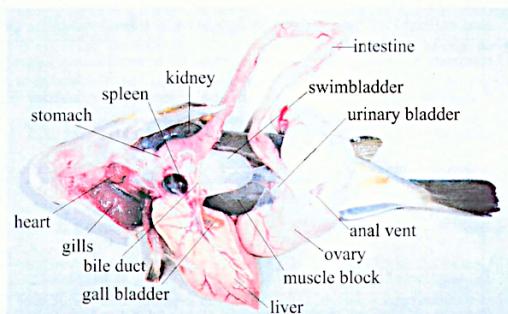
Accordingly, puffer fish with a poison level above 10 MU/g are considered unsafe for consumption according to the Japanese health authorities. In addition, where 10,000 MU is the minimal lethal dose of TTX for humans.

The level of poison vary among fish organs. For example, the fish skin, intestine, liver and ovaries might contain higher toxin(TTX) concentration than fish muscle. For this reason, muscle part of puffer fish in some cases is still available for human consumption in specialized restaurant certified by the governments, mainly in Japan, China, USA and Taiwan.

Autonomy	Illustration
<p>Simplified autonomy drawn by YANG YU HSIANG, 2022.</p> <p>Note: The red triangles, including skin, liver and ovary are the often-eaten part but with higher toxin level.</p>	

Anatomy of the dissected puffer fish
(Source:)

Fig. 5.3 Anatomy of a dissected specimen *Chelonodon patoca* (Hamilton, 1822)



The toxin, TTX, was named in 1909 by Japanese scientist Dr. Yoshizumi Tahara and had been long believed to be present only in puffer fish. However, after that, TTX has been found from the eggs of the California newt, Goby *Yongeichthys criniger*, atelopid frogs, the blue-ringed octopus *Hapalochlaena maculosa*, the carnivorous gastropod, *Charonia sauliae*, starfish of genus *Astropecten*, xanthid crabs, the horseshoe crab, *Carcinoscorpius rotundicauda*, flat-worms, ribbon worms and so on.

According to the chemical scientific report, TTX is a potent nonprotein low-molecular-weight neurotoxin that inhibits the conduction of action potentials by blocking voltage-gated sodium channels in nerve and muscle membranes. It is insoluble in organic solvents and water, stable under neutral and weakly acidic solutions, and **is not degraded by cooking.**

TTX has a highly unusual structure that contains a single guanidinium moiety attached to a highly oxygenated carbon backbone. The carbon backbone of TTX consists of a 2,4-dioxaadamantane structure, decorated with five hydroxyl groups (Fig. 1). The hydroxyl groups on the fused ring systems increase the ability to react in aqueous environments. This toxin is **odorless and heat stable** but **unstable at pH levels** above 8.5 and below 3.0.

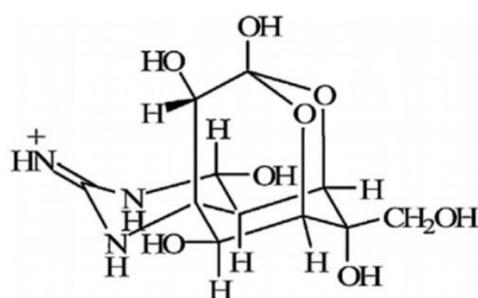


Figure 3 Chemical structure of , tetrodotoxin, TTX

Sorce:

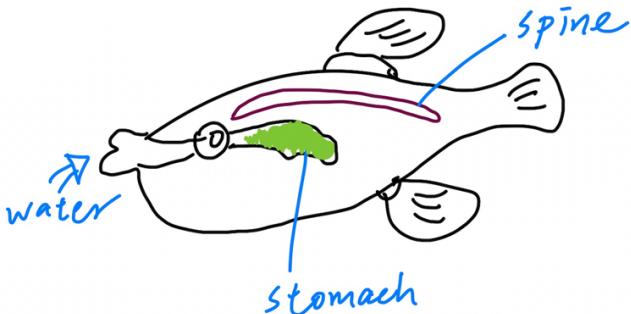
Humans as the top position of food chain are sensitive to the puffer fishs toxin, TTX,. The **minimum lethal dose for humans is 2mg**. Currently, there is no antidote or treatment for TTX poisoning. In another word, **there is no cure for the TTX poisoning**, there is only symptomatic and supportive care providable at the moment. Moreover, when consuming TTX, it is crucial to remove the toxic material from the body as soon as possible.

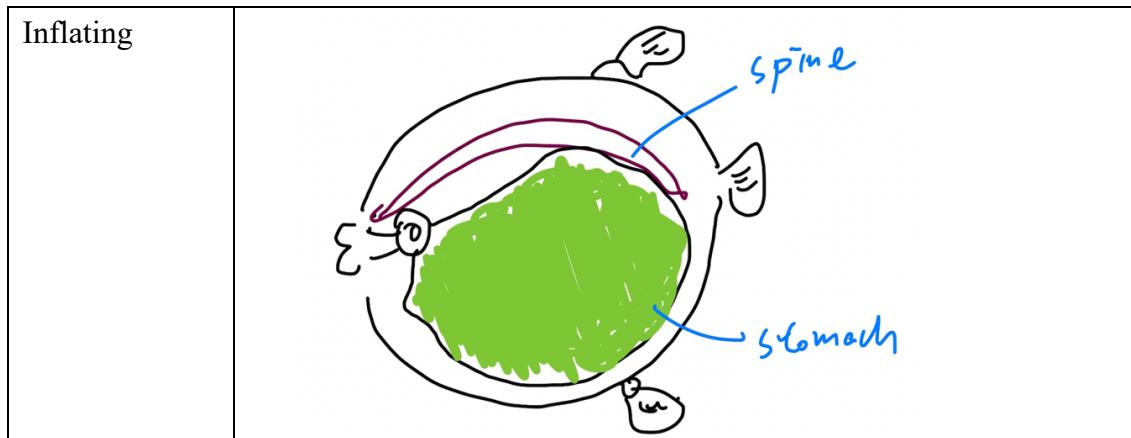
The typical symptoms of TTX poisoning are numbness of lips, tongue, and limbs, paresthesia (a neurosensitive disorder), dysarthria (difficulty in speaking due to a malfunction of the motor organs responsible for phonation), respiratory distress, and death resulting from respiratory failure.

why does puffer fish puff?

Puffer fish are famous for their ability to swell like a balloon. The swelling behavior occurs because the puffer fish ingest many air or water into its expandable stomach and alter its pectoral gridle and head. Accordingly, the shape of puffer fish swell to ball-shape with its elastic fish skin and absence of ribs. The swelling reshaping behavior is a defense mechanism against predators, which are not able to swallow inflated puffer fish.

Table 2 Mechanism of body inflation of puffer fish. (Drawing: YANG, YUHSIANG, 2022)

state	illustration
Not inflating	



Habitation Place of puffer fish

Puffer fish species are mainly tropical and found in all oceans worldwide, except those near the poles. Most puffer fish species inhabit the Pacific Oceans and Indian Oceans. As for the time variation, during the spawning season (in spring/summer, between May and July), most puffer fish are more toxic to protect their fertilized eggs. Usually, the toxic level is the least during the winter because of the reduced activity of toxin-producing bacteria caused by a drop in seawater temperature, which occurs in winter.

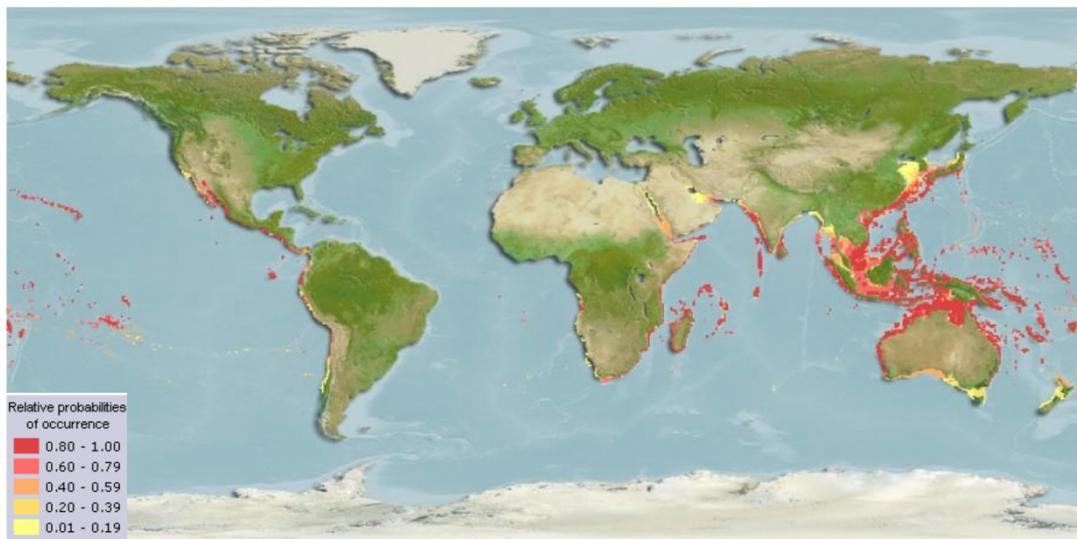


Figure 4 Rough distribution of appearance of puffer fish on earth, taking *L. sceleratus* puffer fish as an example. Source:



Figure 5 Regions affected by puffer fish eating poisoning worldwide. Including Bangladesh, Cambodia, China, Israel, Japan, Singapore, Taiwan, Thailand and United State. Source:

3.2 How puffer fish eating culture form?

Certain types of puffer fish are highly toxic and have been reported to cause food poisoning in various nations, including Japan, Thailand, Taiwan, Cambodia and Bangladesh.

The majority of cases of TTX poisoning and related deaths occur in Japan, China, and Taiwan, where puffer fish are traditionally consumed and considered a delicacy. In Brazil, puffer fish are sporadically consumed by local populations, and some cases of TTX poisoning have been reported. Some cases have also been reported in countries such as Singapore, Thailand, Hong Kong, Malaysia, Bangladesh, Papua New Guinea, Australia, Hawaii, Europe, and Haiti. However, as a result of the agreement reached between Japanese and US governments on importing puffer fish, intoxication cases and resulting damage are rare.

In most cases, raised puffer fish are less toxic than wild ones because their TTX content is significantly lower. Moreover, livers of puffer fish are considered delicious and nutritious due to their unsaturated fatty acids.

According to Japanese food safety standards, puffer fish with a toxicity level below 10 MU/g are deemed as safe for human consumption. On top of that, puffer fish consumption is allowed only if it is prepared and cooked by a highly trained chef who has passed the necessary examination and has obtained a license to cook puffer fish. Japanese Government also published posters to raise communal awareness about poisonous puffer fish species.

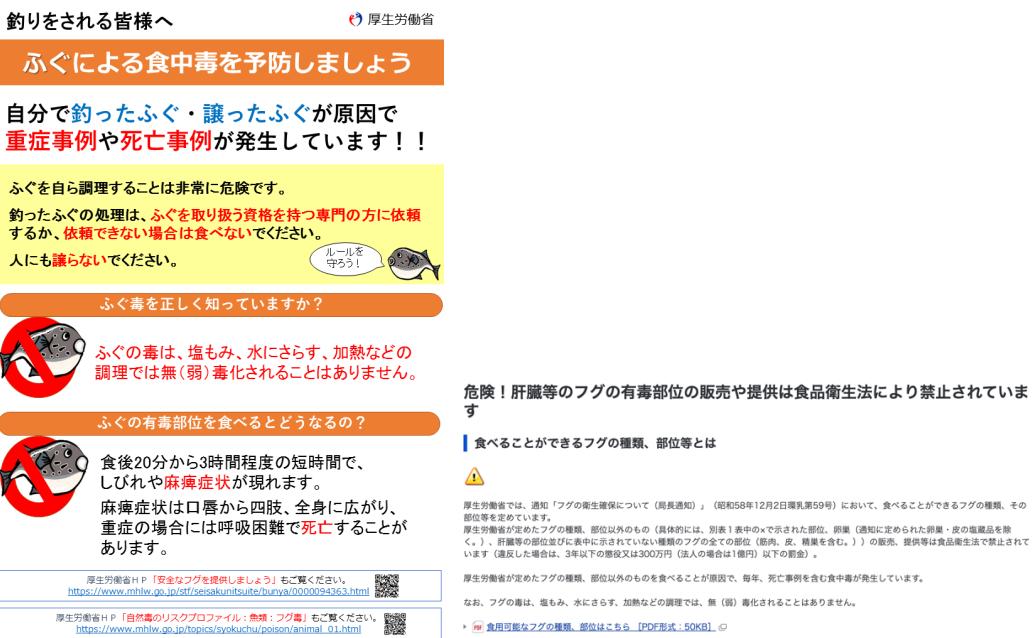


Figure 6 Posters of food safe of eating puffer fish. The left up one is from Tokyo government and the right up one is from national puffer fish alliance in Japan. The left bottom one is the poster made by the ministry of health, labour and health of Japanese government for leisure fishing citizen, warning them about the danger of puffer fish. The right bottom one is the website page of the ministry of health, labour and health of Japanese government for warning of eating and selling puffer fish. Sorce:

Poisoning cases associated with puffer fish consumption have been reported continuously. From year 2018 to year 2013, 5 years, 430 cases of intoxication and 52 deaths associated with puffer fish were reported. The most serious cases occurred recently, with 141 intoxications and 17 deaths in Bangladesh in 2011, and 192

intoxications that resulted in 22 deaths in Taiwan in 2012. These findings suggest that illegal imports of puffer fish and consumers preparing these fish at home still occur because people may be unaware of the associated risks.

To tackle the puffer fish eating poisoning problem, Japan government made a law in which all cases of puffer fish poisoning must be reported. Moreover, Japanese Ministry of Health, Labour and Welfare published guidelines for edible puffer fish in 1983 to lower the frequency of TTX poisoning cases due to puffer fish consumption.

Since the guidelines were published, the number of accidents in specialty restaurants has almost been eradicated, but many cases of such poisoning continue to occur because people eat homemade dishes that contain toxic portions of fish, such as liver and ovaries, after catching puffer fish recreationally.

On the other hand, most nations on earth have banned puffer fish consumption. According to Annex III of Regulation 854/2004 of the European Parliament and Council, Selling Tetraodontidae family fish in the European Community is legally prohibited.

In the United States, puffer fish poisoning cases are low because an agreement was reached between Japan and the U.S.A that imported puffer fish can be sold when it is below the legal toxin level and can only be sold to restaurants that belonging to the Torafugu Buyers Association and the resell and transfer is legally prohibited.

Pufferfish on the dining table

The Pufferfish dish is served as sashimi and nabemono(which is hotspot). The liver was served as a traditional dish named fugu-kimo, being widely thought to be a tasty part, but it is also the most poisonous, and serving this organ in restaurants was banned in Japan in 1984. Now, Puffer fish has become one of the most celebrated dishes in Japanese cuisine.



Figure 7 Fugu, also known as pufferfish or blowfish, contains the potent neurotoxin tetrodotoxin in their organs. Source:



Figure 8 Sashimi puffer fish(raw fish) Source: By The original uploader was Suguri F at Japanese Wikipedia. - Transferred from ja.wikipedia to Commons by lilyu., CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=5108540>



Figure 9 Puffer fish hotspot(fugunabe) Source: CC BY 3.0, <https://en.wikipedia.org/w/index.php?curid=22140167>



Figure 10 Puffer fish sold in Tsukiji Market in Tokyo, Japan. Source: By Chris 73 / Wikimedia Commons, CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=19679>



Figure 11 Liver organ of puffer fish sold in the normal supermarket in Japan. Source:

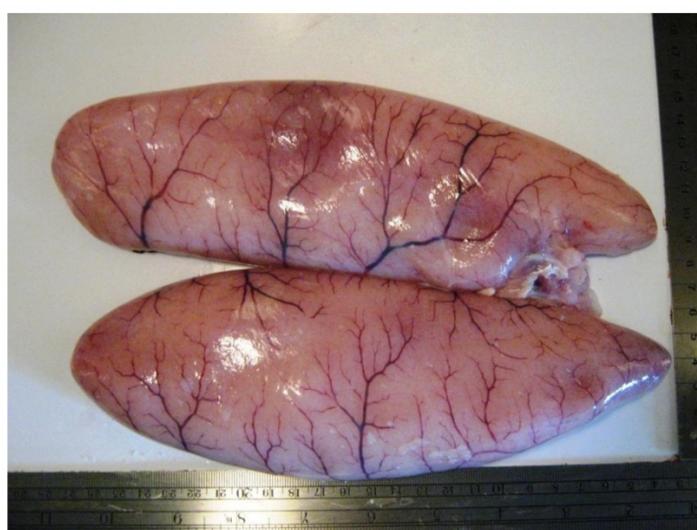


Figure 12 Ovaries organ of puffer fish. Source:

The inhabitants of Japan have eaten puffer fish (in Japanese language : fugu) for centuries. Fugu bones have been found in several shell middens, called kaizuka, from the Jōmon period that date back more than 2,300 years.

The Tokugawa shogunate (1603–1868) prohibited the consumption of fugu in Edo areas. It became common again as the power of the Shōgunate weakened. In western regions of Japan, where the government's influence was weaker and fugu was easier to get, various cooking methods were developed to safely eat them.

Despite the banning of eating puffer fish in Edo era, in a cooking story written in 1643 in the Edo Period, a fugu soup was mentioned as a way to cook fugu.

"To make a fugu soup, skin the fugu, dispose of the organs, and carefully remove the hidden liver from its belly. Wash it well until no blood remains, and immerse it first in unrefined sake, and then add refined sake. Slightly dilute nakamiso and boil the soup, and add the fish. Once a bubble appears, pour a little unrefined sake, and adjust the salt seasoning. Use garlic, eggplant as a fragrant garnish" and so on.

Matsuo Basho and Kobayashi Issa, the famous haiku poets, made haiku using fugu dishes as season words. Because fugu eating was strictly regulated, fugu dishes were not commonly eaten.

During the Meiji Era (1867–1912), puffer fish was again banned in many areas. The Emperor of Japan has never eaten fugu due to an unspecified "centuries old ban". The prohibition of eating puffer fish was gradually lifted in the Meiji era in year 1888, after Ito Hirobumi ate fugu at Shunpanro.



Figure 13 Ancient painting of recognition of the puffer fish in Japan. Fugu (right) and Japanese amberjack by Hiroshige (1832). Source: Utagawa Hiroshige, 2004



Figure 14 Old Japanese painting including preparing puffer fish for dining. The restaurant in Shinagawa, Tokyo, the restaurant that can see the ocean. 『五十三次の内 品川』三代歌川豊国 画, year 1847.



Figure 15 Zoom-in version of old Japanese painting including preparing puffer fish for dining. The restaurant in Shinagawa, Tokyo, the restaurant that can see the ocean. 『五十三次の内 品川』三代歌川豊国 画, year 1847.

Table 3 Time table of legislation of eating puffer fish(fugu) in Japan

Years	Periods	Puffer fish permitted	Content
Jōmon 縄文時代	Before 10 B.C.	YES	Fugu bones have been found in several shell midden
安土桃山時代	1698	No	<p>Among samurai who gathered in Kyushu for the battles of Bunroku and Keicho, many died from fugu poisoning. This resulted in the publication of prohibition on eating fugu by Toyotomi Hideyoshi.</p> <p>Many clans prohibited its samurai to eat fugu (the prohibition was particularly stringent in the Choshu clan). When eating fugu is uncovered, the family was confiscated of its hereditary stipend or underwent other harsh punishments.</p>
江戸時代 Edo Era	1603–1868	No	Tokugawa shogunate prohibited the consumption of fugu in Edo areas. But the Kansai areas sometimes ate fugu. At that time, puffer fish cuisine occurred in the poem of Japanese literature.
江戸時代 Edo Era	1643	No, but	In a cooking story written in 1643 in the Edo Period, a fugu soup was mentioned as a way to cook fugu.
Meiji Era 明治時代	1867–1912	No	Puffer fish was again banned in many areas. The selling of raw and alive puffer fish was legally prohibited.
Meiji Era Year 21 明治 21 年	1888	YES	<p>The first city to have the ban lifted was Shimonoseki City in Yamaguchi prefecture.</p> <p>The Japanese authorities Ito Hirobumi ate fugu at a classy restaurant called, “Shunpanro” in Shimonoseki City in Yamaguchi prefecture in Japan and was surprised by its delicacy. After that, he</p>

			urge local governments to make eating puffer fish legal. At present, the city has its own brand of fugu called "Shimonoseki Fugu" and it has become a distribution hub for fugu caught not only within Japan, but from all around the world.
Meiji Era 25 明治 25 年	1892	YES	Tokyo permit to sell puffer fish whose organs were removed.
World War 2 (1937-1945)			
Showa Era 23 昭和 23 年	1948	YES	The law of food and sanitary was made by local governments in Japan. Osaka made the earliest law to regulate the standard process of selling puffer fish.
Showa Era 24 昭和 24 年	1949	YES	Tokyo made the earliest "professional puffer fish chef licence" system in Japan.
Showa Era 58 昭和 58 年	1983	YES	The central Japan government made a new law and specify 21 species of puffer fish ban be sold on the food market.
Reiwa Era 4 令和 4 年	2022	YES	The unofficial alliance, "puffer fish alliance" wants to make a global standard for puffer fish dining instead of using 47 prefectures' own different regulation.



Figure 16 The left one is the photo of the 1st legal puffer fish Restaurant in Japan called, "Shunpanro" in Shimonoseki City in Yamaguchi prefecture in Japan Tzu-hsun Hsu, Self-photographed, CC BY-SA 4.0, <https://commons.wikimedia.org/w/index.php?curid=76569772>. The right one is the position of Shunpanro on Japanese Map.



旧春帆樓庭園 左から2番目が伊藤博文公

Figure 17 old photos of Ito Hirobumi(the second left people in the photograph) ate fugu at a classy restaurant called, “Shunpanro” in Shimonoseki City in Yamaguchi prefecture in Japan. Source: <https://www.shunpanro.com/about/history.html>

The torafugu (in Japanese langauge: ト ラ フ グ) , which is also called tiger pufferfish, *Takifugu rubripes*, Japanese pufferfish, is the most prestigious edible species and the most poisonous. Other species are also eaten; for example, *Higanfugu* (*T. pardalis*), *Shōsaifugu* (*T. vermicularis* syn. *snyderi*), and *Mafugu* (*T. porphyreus*). The Ministry of Health, Labour and Welfare of Japan provides a list that shows which species' body parts can be consumed. The list names safe genera including pufferfish of the *Lagocephalus* and *Sphoeroides* genera and the related porcupinefish (*Harisenbon*) of the family *Diodontidae*.



Figure 18 Torafugu, source: Scientific Name / Takifugu rubripes (Temminck and Schlegel, 1850)

Table 4 Taxonomy of Torafugu, a kind of common eaten puffer fish in Japan

Taxonomy	Position of Toragufu	分類法	トラフグの位置
Kingdom	Animalia	界	動物界
Phylum	Chordata	門	脊索動物門
Class	Actinopterygii	綱	条鰓綱
order	Tetradontiformes	目	ふぐ目
Family	Tetradontidae	科	ふぐ科
Genus	Takifugu	属	トラフグ属
Species	Takifugu rubripes (which is toragufu)	種	トラフグ

Since 1958, fugu chefs must earn a license to prepare and sell fugu to the public. This involves a two- or three-year apprenticeship. The licensing examination process consists of a written test, a fish-identification test, and a practical test, preparing and eating the fish. Only about 35% of the applicants pass. Small miscalculations result in failure or, in rare cases, death. Consumers believe that this training process makes it safer to eat fugu in restaurants or markets.

Since October 2012, restaurants in Japan have been permitted to sell fugu that has been prepared and packaged by a licensed practitioner elsewhere.



Figure 19 Chef license of permission to cooking puff fish issued by Tokyo government, which is the local government in Japan. Source : By Nesnad - Own work, CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=25129201>

Most Japanese cities have one or more fugu restaurants, perhaps in clusters because of earlier restrictions, as proximity made it easier to ensure freshness. A famous restaurant specializing in fugu is Takefuku, in the Ginza district in Tokyo. Zuboraya is another popular chain in Osaka.

Aqua Technology, Culture the toxin-free Puffer fish

Also, commercially available fugu is sometimes grown in environments in which it grows to be less toxic. Farmers now produce poison-free fugu by keeping the fish away from the bacteria; Usuki, a town in Ōita Prefecture, has become known for selling non-poisonous fugu. Scientists at Nagasaki University have succeeded in culturing non-toxic torafugu by restricting the fish's diet. The experiment included raising over 5,000 fish between the years 2001–2004, and analyzing the toxicity of muscle, skin, gonads, livers, and other organs. The team concluded that the amount of tetrodotoxin in all those parts was non-toxic, and it would allow for the safe preparation of fugu-kimo (puffer liver).



Figure 20 The left ones show the high density of puffer fish restaurants in Usuki, a town in Ōita Prefecture. The right ones shows the homepage of website of puffer fish restaurant alliance of Usuki.



Figure 21 Nagasaki University research on less-toxic puffer fish for human consumption. Source:

Puffer fish legal regulation in Japan now

Nowadays in year 2022, at Japan, the source of puffer fish and the process of cleaning and cooking puffer fish was strictly regulated by the government. However, there are still reported puffer fish poisoning incidence according to the ministry of Health, Labour and Welfare of Japan government. In year 2020, there were 20 puffer fish eating poisoning cases and 1 related death. In year 2021, there were 13 puffer fish eating poisoning cases and 0 related death.

Despite the permission of selling puffer fish cuisine, the liver part and other toxic organs including livers and ovaries are strictly legally prohibited by the government. So far, there were only 21 family of puffer fish legally edible in Japan and only muscle, skin and testis 3 parts of puffer fish were legally edible. If the restaurants sell the illegal puffer fish species or organ part, they might face 3 year jail time or 3 million JPY fine(the cooperation might up to 100 million JPY).

However, according to the news report from Japanese local journalism, the Sankei News in 2016, there was a restaurant in Osaka prefecture in Japan provided puffer fish liver to their VIP customer who enjoy the little bit paralyzed feeling on their tongue due the toxin of puffer fish. After the news report, the police office intervened and the restaurant was forced to shut down for a while.

Table 5 Puffer fish poisoning reported cases in Japan

フグによる食中毒発生状況

	事件数	(再掲)家庭で発生した件数	患者数	(再掲)家庭で発生した患者数	死者数	(再掲)家庭で発生した死者数
平成15年	38	31	50	40	3	2
平成16年	44	32	61	40	2	1
平成17年	40	33	49	40	2	2
平成18年	26	18	33	22	1	1
平成19年	29	20	44	24	3	3
平成20年	40	28	56	38	3	2
平成21年	24	16	50	20	0	0
平成22年	27	21	34	26	0	0
平成23年	17	13	21	15	1	0
平成24年	14	12	18	15	0	0
平成25年	16	12	21	15	0	0
平成26年	27	20	33	24	1	1
平成27年	29	21	46	25	1	0
平成28年	17	13	31	18	0	0
平成29年	19	17	22	20	0	0
平成30年	14	13	19	18	0	0
令和元年	15	13	18	14	1	1
令和2年	20	19	26	25	1	1
令和3年	13	12	19	18	0	0

Table 6 Legal permitted edible puffer fish species and organs in Japan

別表1 処理等により人の健康を損なうおそれがないと認められるフグの種類及び部位

科名	種類(種名)	部位		
		筋肉	皮	精巣
フグ科	クサフグ	○	—	—
	コモンフグ	○	—	—
	ヒガンフグ	○	—	—
	ショウサイフグ	○	—	○
	マフグ	○	—	○
	メフグ	○	—	○
	アカメフグ	○	—	○
	トラフグ	○	○	○
	カラス	○	○	○
	シマフグ	○	○	○
	ゴマフグ	○	—	○
	カナフグ	○	○	○
	シロサバフグ	○	○	○
	クロサバフグ	○	○	○
ハリセンボン科	ヨリトフグ	○	○	○
	サンサイフグ	○	—	—
	イシガキフグ	○	○	○
	ハリセンボン	○	○	○
ヒトヅラハリセンボン	ヒトヅラハリセンボン	○	○	○
	ネズミフグ	○	○	○
ハコフグ科	ハコフグ	○	—	○

注1 本表は、有毒魚介類に関する検討委員会における検討結果に基づき作成したものであり、ここに掲載されていないフグであっても、今後、鑑別法及び毒性が明らかになれば追加することもある。

2 本表は、日本の沿岸域、日本海、渤海、黄海及び東シナ海で漁獲されるフグに適用する。ただし岩手県越喜来湾及び釜石湾並びに宮城県雄勝湾で漁獲されるコモンフグ及びヒガンフグについては適用しない。

3 ○は可食部位

4 まれに、いわゆる両性フグといわれる雌雄同体のフグが見られることがあり、この場合の生殖巣はすべて有毒部位とする。

5 筋肉には骨を、皮にはヒレを含む。

6 フグは、トラフグとカラスの中間種のような個体が出現することがあるので、これらのフグについては、両種とも○の部位のみを可食部位とする。

3.3 Should we eat puffer fish?

When it comes to puffer fish, which is also called fugu, Japan is the most famous country who put this toxic fish on the dining table. The puffer fish is so toxic that most rest of the country on earth banned the import and the consumption of puffer fish. Simultaneously, puffer fish was, have been and will be a delicacy on the dining table of Japan.

Eating puffer fish has a long history in Japan. Although eating puffer fish had once been banned by the authority, Japan nowadays permit some puffer fish species and some organs which is safe for human's consumption. In the opinion of this article, I think puffer fish is edible only in the case that it follows the regulation of Japan governments. There were so many puffer fish restaurants in Japan but less than 20 cases every year was reported in Japan from year 2017 to year 2021. Accordingly, it is relative low risk and safe to eat legal puffer fish in Japan.

4. Conclusion:

In conclusion, Japan society is quite interesting that they specifically eat the toxic fish which other culture or society do not eat. Moreover, despite most of Japanese people or restaurants follow the government rule, the law-breaking incidence and illegal puffer fish might still happen in Japan. That is, we can understand Japanese society has its own insistence in their delicacy. Instead of giving up eating risky puffer fish, Japan society chose to improve cultivation of puffer fish the process and cooking skill to keep the long-history seafood tradition go on and on.

5. Bibliography

Inouye, Kathryn Harkup; Itsuo. "Tetrodotoxin: The Poison Behind the Japanese Pufferfish Scare." *The Gaurdian* (2018).

Ministry of Health, Labour and Welfare of Japanse Government. "安全なフグを提供 しましょう." (2022). Accessed 2022/11/10.
<https://www.mhlw.go.jp/stf/seisakunitsuite/bunya/0000094363.html>.

Nader, Manal, Shadi Indary, and Layal Boustany. *The Puffer Fish *Lagocephalus Sceleratus* (Gmelin, 1789) in the Eastern Mediterranean*, 2013.

Panão, Inês, Conrado Carrascosa, José Raduán Jaber, and António Raposo. "Puffer Fish and Its Consumption: To Eat or Not to Eat?", *Food Reviews International* 32, no. 3 (2016/07/02 2016): 305-22.
<https://dx.doi.org/10.1080/87559129.2015.1075213>.

Yamaguchi, Mari. "Scientists Make Fish Delicacy Less Deadly ." *NBC News* (2004). Accessed 2022/11/10.

Yu, Chun-fai. "A Comprehensive Study of the Hong Kong Puffer Fishes and Their

Toxins." *Hong Kong Polytechnic University -- Dissertations* xxiv (2003): 248.