Observations from the Survey into Regional Characteristics of Soy Sauce and Contributing Factors

Ayako Ehara, Professor Emeritus at Tokyo Kasei Gakuin University

Survey Details and Regions Covered

Over two years from 2016 to 2018, an interview-based survey of soy sauce breweries (hereafter, breweries) was conducted to clarify the regional characteristics of soy sauce and possible contributing factors. The survey was led by research representative Hiroshi Tachi with co-researchers Yuka Utsunomiya and Nami Fukutome. A total of 127 breweries from almost every prefecture in Japan cooperated in interviews and also responded to a questionnaire on their history, production volumes, production ratios by soy sauce type and JAS (Japan Agricultural Standard) method, among other details.

This report focuses on the regions not covered by last year's report. In addition, I provide an overview of the soy sauce industry today through analysis of the nationwide survey data, considering possible observations that can be drawn, in particular, from responses to the survey questionnaire.

As mentioned previously, while there exists some statistical data telling us about the regional characteristics of soy sauce and possible contributing factors, much is still unclear. For example, while it is commonly understood that soy sauce in Kyushu is sweet, there had been no extrapolation to consider sweet soy sauces in other areas. And while it was thought the sweetness of soy sauce in Kyushu was influenced by the history of a sugar culture in the nearby Satsuma and Amami regions, this survey shows that it is not so simple. We need to recognize that the flow of history has brought with it many significant transitions and changes affecting the regional flavor of soy sauce and production methods at each stage.

Despite not gaining complete responses to the questionnaire – about 110 companies responded, but not all items were answered – I thought that plotting the data on a map may provide us with a high-level view of each region's unique characteristics. Before sharing the results, however, I would first like to review the historical development of soy sauce production and key transition points over time.

Ayako Ehara

Born in Shimane Prefecture, Ms. Ehara graduated from the Division of Food Science, Department of Home Economics, Ochanomizu University, and received Ph.D. in Education. After serving as a professor at Tokyo Kasei Gakuin University, Ms.Ehara assumed her current position as professor emeritus and visiting professor at Tokyo Kasei Gakuin University. She specializes in food culture history, dietary education history, and the science of cooking.

Her published works include *Katei Ryori no Kindai* (author), *Washoku to Shokuiku* (editor), *Nihon no Shokubunka-shi Nenpyo* (co-editor), *Nihon Shokumotsu-shi* (co-author), and *Oishii Edo Gohan* (co-author).

Historical Development of Soy Sauce Production

In the previous issue we followed the transition of soy sauce production in the Edo period from soybeans and barley as raw materials, to a blend of soybeans, barley and wheat, and then further to a mixture of equal amounts of soybeans and wheat similar to present-day production, in a constant search for more delicious flavor. However, records on the number of days required for preparation range from 30 days to as long as one year. And additives varied greatly from koji and sake lees to a dark-colored sweet syrup that was a by-product of steaming soybeans, and sugar was even added according to late Edo period historical materials in Ono Town, Kanazawa City. Although these reveal regional differences in additives and production methods, it can be said that the purpose was likely not to sweeten the soy sauce but rather to temper the saltiness and improve overall quality.

In 1877, the first National Industrial Exhibition was held in Ueno, Tokyo, creating momentum for producers to improve the quality of the soy sauce they exhibited. Scientific research flourished at soy sauce test laboratories, and the industry saw advancements in research on brewing science and improvements in presses and other equipment. At the same time, the market for raw materials changed: domestic soybeans used since the Edo period were replaced around the turn of the 20th century by soybeans from northeastern China, and imports of wheat from Canada, the United States and other countries began soon after. It was also at this time the industry witnessed expansion of production at modernized factories made possible by the merger of breweries into large-scale soy sauce companies.

However, as the country progressed into a wartime regime, it suffered from soaring prices and shortages of raw materials. Test-brewing of soy sauce made with defatted soybeans (in pressed sheet form) from China was already underway, and some of it was used after 1930. However, after food controls were instituted in 1940, the only available raw material for soy sauce was defatted soybeans, and traditional methods of brewing with soybeans and wheat virtually disappeared.

Methods for obtaining seasonings by decomposing wheat flour and defatted soybeans with hydrochloric acid and other solutions were already under development in the amino acid industry, with such products sold to brewers as soy sauce flavorings. However, these methods proved uneconomical, and in 1936, a substitute for soy sauce came in the form of an amino acid solution developed by refining residual liquid from the former decomposition process, the quality of which was improved by adding sugars obtained by defatting soybeans. Soy sauce with added amino acid solution was also produced at this time. However, when food supplies grew especially tight in 1943, even rations of defatted soybeans stopped, forcing the suspension of production. When wheat could no

longer be used as a raw material for soy sauce, there were even attempts to use coarse wheat bran.
Soy sauce lees gained attention as a useful substitute during times of scarce supplies. Pressed lees had been used as a raw material for lower-grade soy sauce called banshoyu since the Edo period when pressing technology was less sophisticated. Several methods for producing banshoyu are described in detail in the Meiji period hand-written manuscript "Soy Sauce Manufacturing Methods", and among them are methods that include added sugar or molasses. During World War II, research was conducted on technology harnessing the power of chemistry to recover nitrogen components remaining in lees, leading to the development of new Manufacturing methods, the "*Kosei Shoyu Seizo-ho*" and the "*shinshiki-ichi-go shoyu Seizo-ho*" among them.
Although food controls continued in the immediate postwar period, in 1948 GHQ (Allied General Headquarters) issued a policy to release soybean meal. Initially, due to the emphasis on effective use of the product, only a small distribution was planned for the time-consuming soy sauce industry. However, with the development of a method called *shinshiki-ni-go*, an improvement by Kikkoman on the *shinshiki-ichi-go* method that it released to the industry without charge, much larger allocations were approved, and a historical crisis for brewed soy sauce was avoided.
Most of the controls were subsequently lifted, including those for soybeans in 1950 and wheat in 1952. In 1955, when a new technology called the NK cooking method of soybeans (History of Soy Sauce – Soyinfo Center 2012, P.1674) was developed and released, traditional *honjozo* soy sauce brewing was revived. However, wartime and post-war shortages of raw materials and frequently revised standards prevented many regional breweries from returning to *honjozo* soy sauce production, and some breweries even lost their brewery equipment for various reasons. It is thought that many companies stayed in business and even developed in the post-war period by devising diversified products, including *kongo* soy sauce and soy sauce–based products like *dashi shoyu*.

Surprisingly Extensive Distribution of Kongo Soy Sauce

Figure 1 shows the distribution of *kongo* soy sauce (JAS manufacturing method classification; mixture method prepared by adding amino acid solution and other substances to *kiage* raw soy sauce) for the breweries we surveyed. The figure shows the ratio of *kongo* soy sauce production per brewery (as compared to *honjozo* and *kongo jozo*), and does not indicate total production volumes. For reference, about 80% of the total production volume in Japan is *honjozo* soy sauce.
The figure reveals that for many breweries in the Kyushu region, *kongo* soy sauce constitutes more than 50% of total production. We can also see a tendency for many breweries in the Tohoku, Hokuriku, Chugoku and Shikoku regions to have a high ratio of *kongo* soy sauce. *Kongo jozo* production (mixed fermenting method) is rarely seen, except in prefectures such as Shimane, Ehime and Kagawa. We can therefore ascertain that regions with a low ratio of *kongo* soy sauce – Hokkaido, Kanto, and Koshinetsu, as well as Aichi, Mie, and Hyogo prefectures – have a high ratio of *honjozo* soy sauce production.
Survey interviews confirmed the trend for high rates of sweeter soy sauce in many parts of Kyushu, as anticipated,

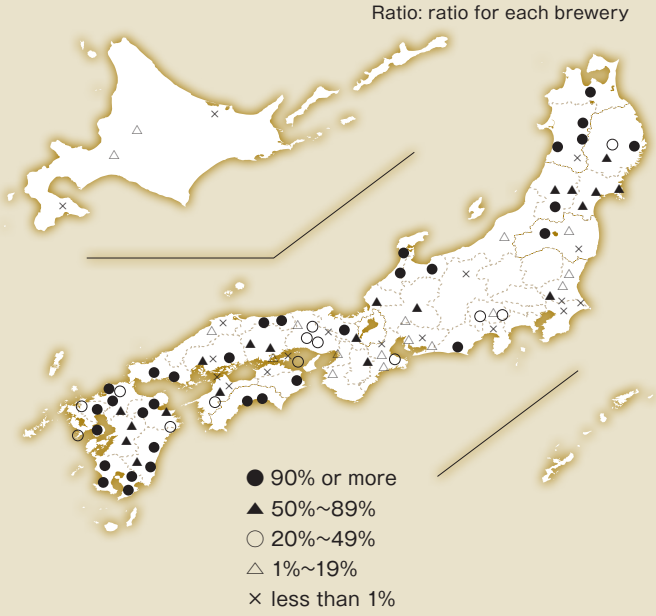

Figure 1. Production Ratio Distribution of *Kongo* Soy Sauce (as Categorized by JAS)

but also in Ehime, Kochi and other Shikoku prefectures, and even in Toyama and other prefectures of the Hokuriku region. This represents almost an exact match with the areas showing a high ratio of *kongo* soy sauce production.
With *kongo* soy sauce, we see many cases of sweeteners being added alongside amino acid solution and enzyme-hydrolyzed seasoning solution. Examination of a *kongo* soy sauce label in the Chugoku region, for example, lists sweeteners (sugar, high-fructose corn syrup), acidulant, flavoring (amino acids, etc.), sweetening agents (licorice, stevia), caramel color, and thickener, in addition to the base ingredients of amino acid solution, defatted processed soybeans, wheat, and salt. Blending multiple sweet and sour flavors with subtle adjustments seems to have enabled producers to adapt their soy sauce to the tastes of the region. I asked about the soy sauce used in a simmered dish of black-throated seaperch at a long-standing sushi restaurant in Shimane Prefecture to learn that it was the local *kongo* soy sauce. And the sashimi I ate at another restaurant in the area was served with thicker, sweeter local *kongo* soy sauce, which they sold in-store as a souvenir. It appears that after the war, efforts such as changing mixing ratios to improve the quality of products first experienced during the hardship of wartime and postwar Japan, allowed for the acceptance and establishment of *kongo* soy sauce as the taste of each region.

Distribution of Soy Sauce by Type

Next, we examined production ratios of each brewery by soy sauce type: *koikuchi*, *usukuchi*, *saishikomi*, *tamari*, *and shiro*, as categorized by JAS. **Figure 2** shows the distribution ratio for *usukuchi* soy sauce. While we know that *koikuchi* soy sauce is distributed throughout the country, it was thought before the survey that *usukuchi* soy sauce was largely concentrated in the Kansai area. However, survey responses showed that it is also manufactured in the Kyushu, Shikoku, and Chugoku regions, among others. In interviews in Kyushu, we heard that thick, dark soy sauce with some sweetness is used for

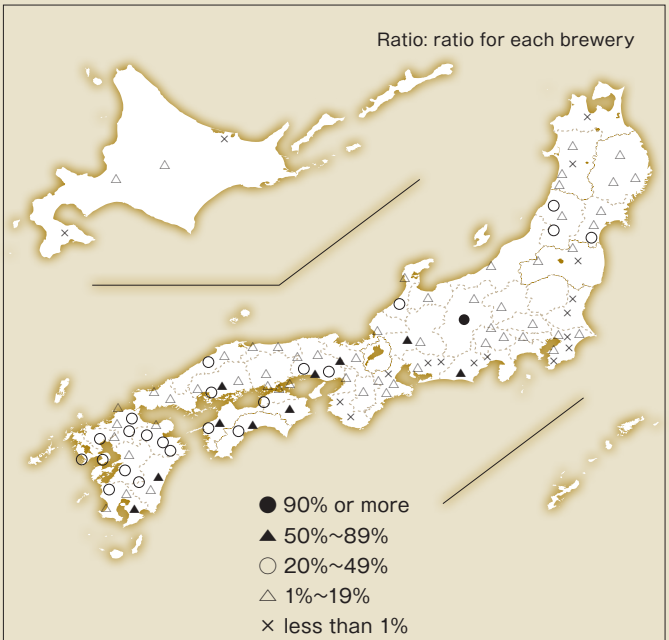

Figure 2. Production Ratio Distribution of *Usukuchi* Soy Sauce

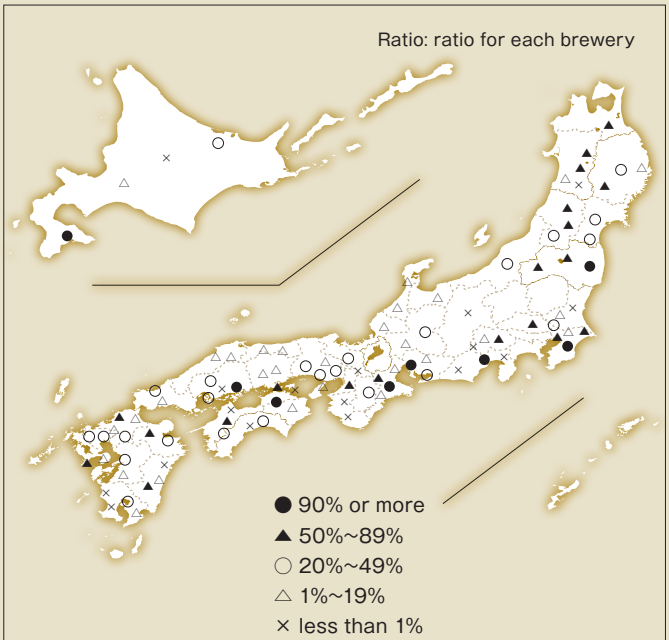

Figure 3. Production Ratio Distribution of Soy Sauce-Based Products

sashimi, but that *usukuchi* is used for simmered dishes in many places. In fact, at a brewery in Miyazaki, 80% of production is *usukuchi* soy sauce, a figure that reached 60% for one brewery in Kagoshima.

Production of *tamari* soy sauce, in contrast, is concentrated in Gifu, Aichi, and Mie prefectures in central Japan, and this variety is rarely manufactured in other areas, except Osaka. Its regionality is very clear, and overlaps with the area where we find a strong and persistent culture of bean miso (soybean paste made only with salt and soybeans), another ancient seasoning. *Shiro* soy sauce production is limited to Hekinan in Aichi Prefecture and in very low ratios in Gunma, Chiba and Saitama prefectures. *Saishikomi* soy sauce is produced in a few cases in the Chugoku region and Shizuoka Prefecture, but largely unseen in most other places around the country.

Diversity in Soy Sauces and Soy Sauce–Based Products

So far, an examination of regional distribution has revealed some distinguishing features of soy sauce around Japan. However, production volumes vary greatly by brewery, with almost incomparable gaps between large-scale brewers in Chiba, Aichi, Mie, Hyogo and Kagawa prefectures, and small-scale regional brewers. What we are seeing is a gradual shift, even at small-scale makers, to production of both *koikuchi* and *usukuchi* soy sauce, as well as by both *honjozo* and *kongo* methods. In addition, many are also investing efforts into the production of *mentsuyu* (noodle soup base) and other soy sauce–based products.

Figure 3 is a distribution chart of the ratio of products not classified as soy sauce but based on soy sauce. There tends to be a high ratio on Japan's Pacific Ocean side of such products, including well-known *kombu* kelp soy sauce in Hokkaido and *dashi shoyu* in the Tohoku Region. The core products at many breweries include varieties such as *kombu* soy sauce, *egoma* perilla soy sauce, *katsuobushi* dried bonito flakes *dashi* soy sauce, and *tsuyu* soup base. Other breweries have instead decided to focus on *honjozo* soy sauce made from whole soybeans, sometimes called *kurazukuri* (literally, storehouse-brewed); while others produce mainly high-grade *kongo* soy sauce, 70% of which is sold inside the prefecture; and yet another group emphasizes the production of *koikuchi honjozo* for shipping outside the prefecture.

Another consideration is that users do not use the same soy sauce for all dishes. The above example of using *usukuchi* for simmered dishes and *koikuchi* for sashimi in Kyushu was also seen in a 2005 questionnaire survey into "Soy Sauce Preferences and Regional Characteristics" by Takagi Tooru. A common behavior in the Tohoku, Kansai, Chugoku, Shikoku, and Kyushu regions is to use thick *sashimi shoyu* or sweet soy sauce for *sashimi*. *Usukuchi* soy sauce is often used for simmered dishes or soups in Kyushu, Shikoku, and Chugoku, and while people in the Kansai area tend to use either *koikuchi* or *usukuchi* in simmered dishes, we observed the use of *tamari* soy sauce for *sashimi*. In addition, recent trends show an increase in the use of *mentsuyu* or *dashi shoyu* as substitutes for soy sauce.

Thus, historical transitions in soy sauce production have changed people's soy sauce preferences. In particular, changes in post-war eating habits prompted not only a preference for the "genuine product" as represented by *honjozo* soy sauce, but also a concurrent preference for *kongo* soy sauce, owing to an attachment to traditionally preferred flavors, including sweetness. Furthermore, lifestyle changes have led to the increased popularity of soy sauce–based products like *dashi shoyu*, the flavor of which can be easily adjusted. As a result today, there is demand for a great variety of soy sauces, selected to suit the time, dish and occasion, both for home use and in restaurants.

Key Reference Oguri, T., 2008, "Survey on Systemization of Soy Sauce Manufacturing Technology", *National Museum of Nature and Science Research Report on the Systematization of Technology*, Vol. 10.