

## Changes in the Social Situation Influence Local Cuisine. - Local Cuisine in Chiba Prefecture, Japan

Korehisa Kaneko<sup>1</sup>, Keiko Oshida<sup>2</sup>, Hajime Matsushima<sup>3</sup>

### Abstract

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To predict the status of local cuisine in response to the change of the social situation in the future, this study surveyed and analysed the affects of the social situation on the regional local cuisine in Chiba Prefecture, Japan. With regard to the relationship between changes of population and infrastructure development (improved and paved rates of roads; total length of national expressways; total length of railroads; number of new houses; and actual Gross Domestic Product (GDP) in all of Japan, including Chiba Prefecture, the correlation coefficients of all items were positive (significant difference  $p < 0.01$ ). The number of food service industries of family restaurants, convenience stores and general merchandise stores has increased since the 1980s, and the food self-sufficiency rate in 2011 decreased by half as compared to that of 1960. The food import volume (both domestic and foreign) has increased. In contrast, the catch of fish and shellfish, which are ingredients of the main local cuisine in Chiba Prefecture, has decreased overall. Furthermore, traditional food culture of the region has weakened, and the westernisation of food has progressed. Consequently, in the future, we need to continue activities in conservation and restoration of the natural environment in the region.

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**Keywords:** Local cuisine, Change of dietary life, Social situation, Infrastructure development, Population

### 1. Introduction

The local cuisine is comprised of a regional production using the methods that have adapted the climate and natural features in the region, and the traditional food culture has been handed down over generations and has taken root for a long time in the region. The local cuisine has benefited from the rich natural resources of the region. Traditional food culture in Japan was registered in the intangible cultural heritage of UNESCO on December 4, 2013 as "Washoku", and it has attracted attention worldwide. However, in recent years, the dietary life in Japan has changed. The food types that are consumed throughout all of Japan have been equalised by the significant development of storage processing technology and distribution. The cooking methods in families are uniform, and local traits have faded from the food habitat resulting in the loss of the local cuisine (Matsushita & YOSHIKAWA 1973). Moreover, externalisation of meals continues today, and the preparation industry flourishes. The dietary life of children is largely changed, and the appearance of children in the kitchen has disappeared. For children, the opportunity to make a meal themselves is reduced, and learning from family about food has also decreased (Sugisaki et al. 2008).

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<sup>1</sup> Ph.D., Hokuso Creature Association. 4-20-5 Tabata, Kita-ku, Tokyo 114-0014, Japan.

E-mail : [k\\_kaneko@hotmail.com](mailto:k_kaneko@hotmail.com), Phone: +81 338247585

<sup>2</sup> Ph.D., Department of Town Planning & Design, College of Science and Technology, Nihon University. Tokyo, Japan.

<sup>3</sup> Ph.D., Research Faculty of Agriculture, Hokkaido University. Sapporo, Japan.

The improvement of food processing technology in Japan, the uniformity of the food types nationwide, and significant development of distribution have made it possible to supply an increased production of food to meet the demands of the significant population growth and high economic growth in this period. However, studies that examine these issues in detail are lacking. These issues should be considered for the inheritance to future generations of an excellent traditional culture with regional cuisine that has been nurtured throughout history and is the nature of the region.

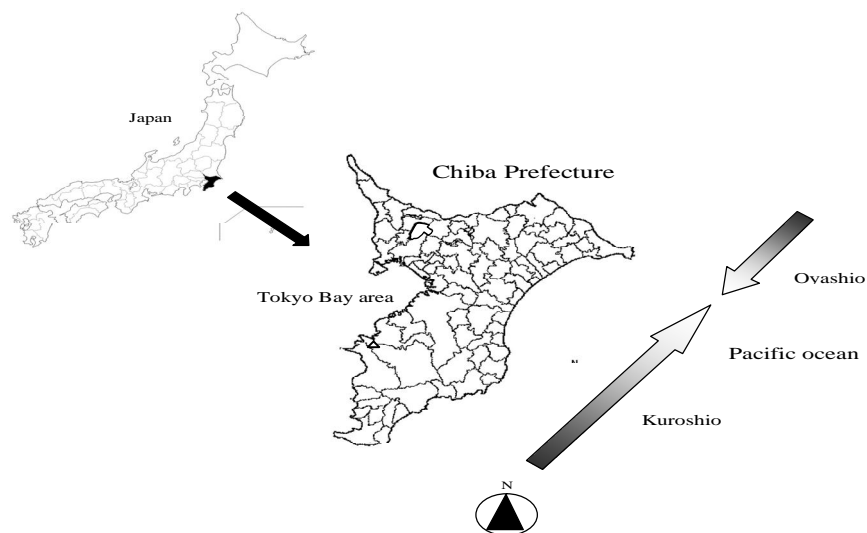
This study examined the status of local cuisine and how it will be affected with regard to the change of the social situation in the future. In addition, this study surveyed and analysed the affects of social situation on the local cuisine of the region targeting Chiba Prefecture, which neighbours Tokyo. Tokyo is the capital of Japan and is one of the municipalities that are affected by increased population, high economy growth, and infrastructure development.

## 2. Methods

### 2.1. Study Site

Chiba Prefecture is the East neighbour of the major city, Tokyo, in the central portion of the Japanese archipelago, and it is surrounded by the sea on three sides by Tokyo Bay and the Pacific Ocean (Figure 1). On the Pacific Ocean side where the Kuroshio (warm current) and Oyashio (cold current) are confluent, there are rich fishing grounds that have been affected by the environment. Fisheries are one of the largest industries in the country, and they focus on coastal and offshore fishing. Moreover, in the Edo period (1603-1867), agriculture and fisheries developed as a source of food to the Edo of the major cities (present Tokyo). In particular, the main local cuisine in Chiba Prefecture uses fish and shellfish as ingredients.

**Figure 1: Study Site**



### 2.2. Sampling Methods

In this study, we investigated how the changes in population and infrastructure development (improved and paved rates of roads; total length of national expressways; total length of railroads; and number of new houses) throughout all of Japan and Chiba Prefecture affected the food service industry due to the fluctuations in the amount of fish and shellfish harvested as the major food of local cuisine in Chiba Prefecture, and we also investigated changes in the single family rate. Changes in population were quoted from the reference of Statistical research and training institute ministry of internal affairs and communication Japan (2012) and Chiba Prefecture (2013).

As for the infrastructure development, the information of road and railroad was quoted from the Statistics Bureau, Ministry of Internal Affairs and Communications, Chapter 12 transportation (<http://www.stat.go.jp/data/chouki/12.htm>).

The number of new houses was quoted from the Statistics Bureau, Ministry of Internal Affairs and Communications, Chapter 2 Population and Household, Agriculture, Forestry and Fisheries (<http://www.stat.go.jp/data/chouki/02.htm>).

The number of convenience stores, general merchandise stores and fast food restaurants was quoted from the Japan Franchise Association (<http://www.jfa-fc.or.jp/particle/19.html>) and Monthly convenience store (2004). The rate of food service and externalisation rate of meals were quoted from the Foundation of Food Safety and Security (<http://anan-zaidan.or.jp/data/>).

The employed population of first industries was quoted from the Bureau of Statistics Office of Prime Minister Japan (1973), Statistical Survey Department, Statistics Bureau, Ministry of Internal Affairs and Communications Japan (2012) and Chiba Prefecture (2012). The food self-sufficiency rate and food import volume were quoted from the Statistical Survey Department, Statistics Bureau, Ministry of Internal Affairs and Communications, Chapter 7 Agriculture, Forestry and Fisheries

(<http://www.stat.go.jp/data/chouki/07.htm>) and the Ministry of Agriculture, Forestry and Fisheries (<http://www.maff.go.jp/j/tokei/kouhyou/zyukyu/#l>). The average catch of ingredients was quoted from the following sources: Ministry of Agriculture, Forestry and Fisheries ([http://www.maff.go.jp/j/tokei/kouhyou/kaimen\\_gyosei/index.html#l](http://www.maff.go.jp/j/tokei/kouhyou/kaimen_gyosei/index.html#l));

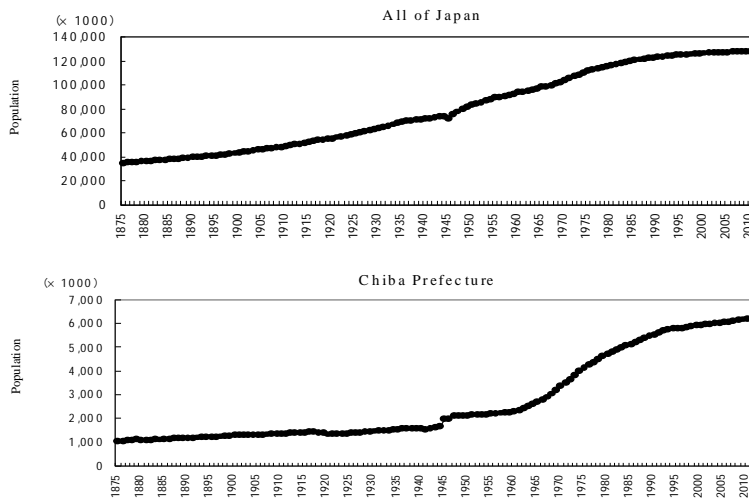
Chiba Prefecture, Agriculture, Forestry and Fisheries Division, Fisheries Station (2012) and Ministry of Agriculture, Forestry and Fisheries Kanto Regional Agricultural Administration Office Agricultural Administration Office Chiba Department of Statistics (2007, 2008, 2009). The data were analysed using principal component analysis to investigate the relationship of food import due to the expansion of the population and infrastructure development with the expansion of food self-sufficiency rate and the food service industry. The analyses were performed using R2.4.1 Vegan1.8-4 software (<http://www.r-project.org,2007.1>).

### **3. Results**

#### **3.1. Population and Infrastructure Development**

We investigated the changes of population and infrastructure development (roads, railroads, and the number of new houses). The changes of population gradually increased throughout all of Japan and rapidly increased since 1965 in Chiba Prefecture (Figure. 2).

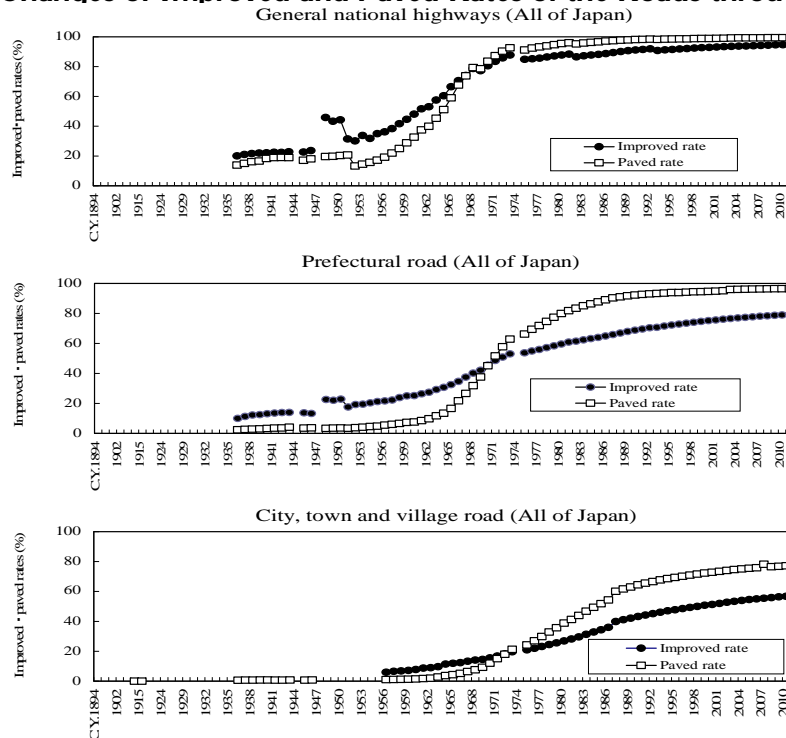
**Figure 2: Changes of Population in Chiba Prefecture and throughout all of Japan**



※ Data quoted from the Statistical Survey Department, Statistics Bureau, Ministry of Internal Affairs and Communications (2012, Chiba Prefecture (2013).

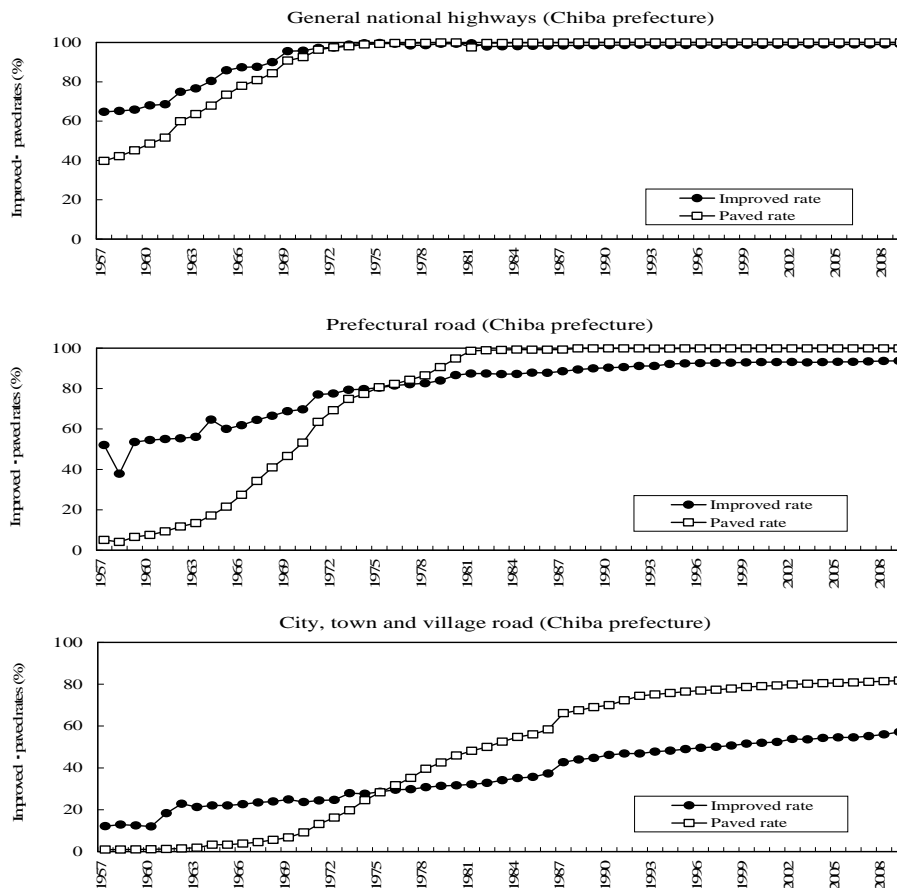
With regard to infrastructure development, the improved and paved rates of roads throughout all of Japan gradually increased since 1955 for national highways, and these rates increased rapidly since 1965 for Chiba Prefectural roads and since 1970 for the city, town and village roads. The length of national expressways rapidly increased since the late 1960s. With regard to infrastructure development in Chiba Prefecture, the improved paved rates rapidly increased since the 1960s for national highways, since 1960-1970s for Chiba Prefecture roads and since 1960-1980s for city, town and village roads (Figure. 3 (1)-(2)).

**Figure 3 (1): Changes of Improved and Paved Rates of the Roads throughout all of Japan**



※ Data quoted from the Statistical Survey Department, Statistics Bureau, Ministry of Internal Affairs and Communications, Chapter12 transportation (<http://www.stat.go.jp/data/chouki/12.htm>).

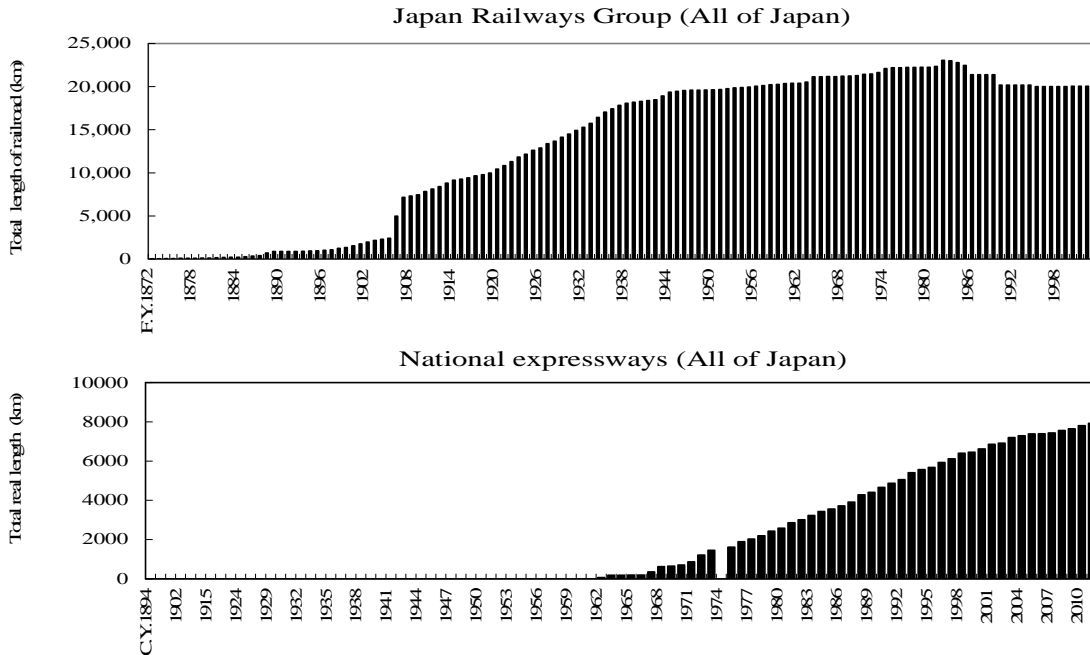
Figure 3(2): Changes of Improved and Paved Rates of the Roads in Chiba Prefecture



※Data quoted from the Statistical Survey Department, Statistics Bureau, Ministry of Internal Affairs and Communications, Chapter 12 transportation (<http://www.stat.go.jp/data/chouki/12.htm>).

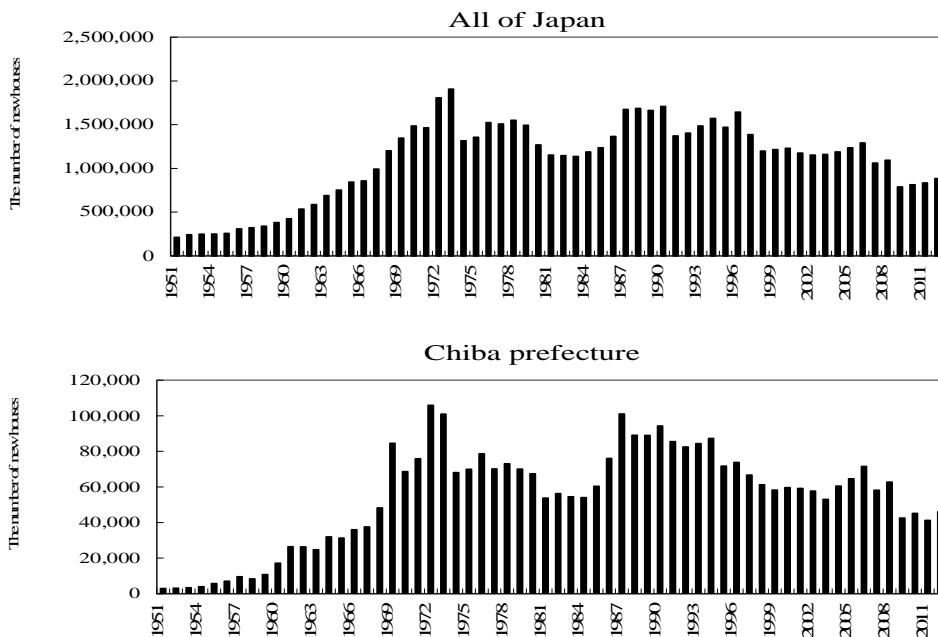
The total length of railroad rapidly increased since the 1900s throughout all of Japan, and it peaked in 1985. Information for the total length of railroads in Chiba Prefecture was not available in detail, so this information was not described (Figure 4). The number of new houses rapidly increased in the late 1950s to the early 1970s throughout all of Japan, and it increased again in the late 1980s. Although the number of new houses in Chiba Prefecture was low compared to that of Japan, the tendency to increase or decrease was similar to that of Japan when considering inter-annual variability (Figure 5).

**Figure 4: Changes of Total Length of Railroad and Total Length of National Expressways throughout all of Japan**



※ Data quoted from the Statistical Survey Department, Statistics Bureau, Ministry of Internal Affairs and Communications, Chapter 12 transportation (<http://www.stat.go.jp/data/chouki/12.htm>).

**Figure.5 Changes of the Number of New Houses throughout All of Japan and Chiba Prefecture**

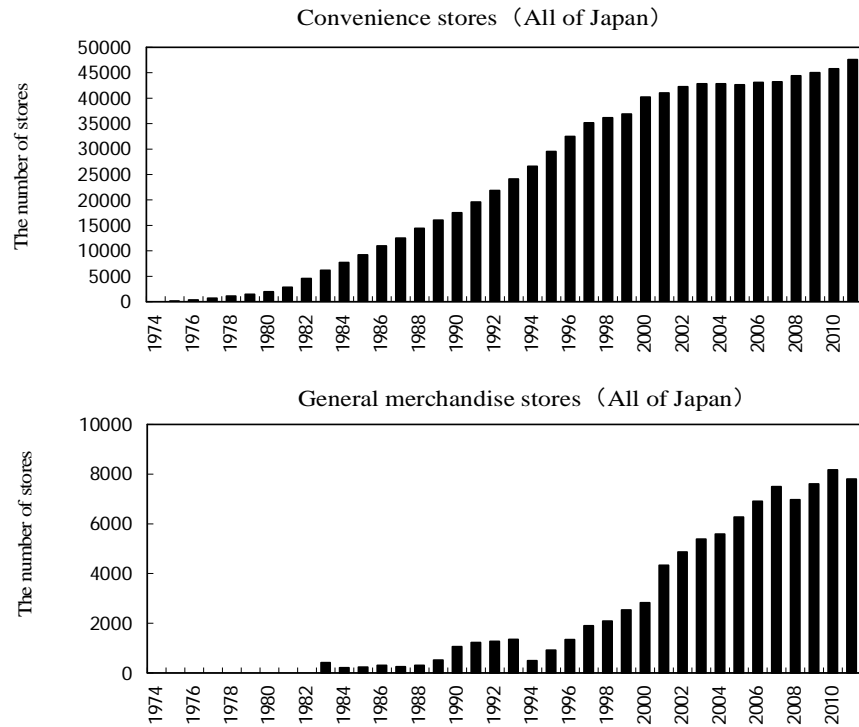


※ Data quoted from the Statistical Survey Department, Statistics Bureau, Ministry of Internal Affairs and Communications, Portal Site of Official Statistics of Japan (<http://www.e-stat.go.jp/SG1/estat/eStatTopPortal.do>).

### 3.2. Change of Dietary Life Style

With regard to the situation change in the number of convenience stores, general merchandise stores (including large and medium sized), fast food restaurants, and family restaurants in Japan, the number of convenience stores increased in the early 1980s to 2000s, and general merchandise stores increased in the mid-1990s to 2010 (Figure 6).

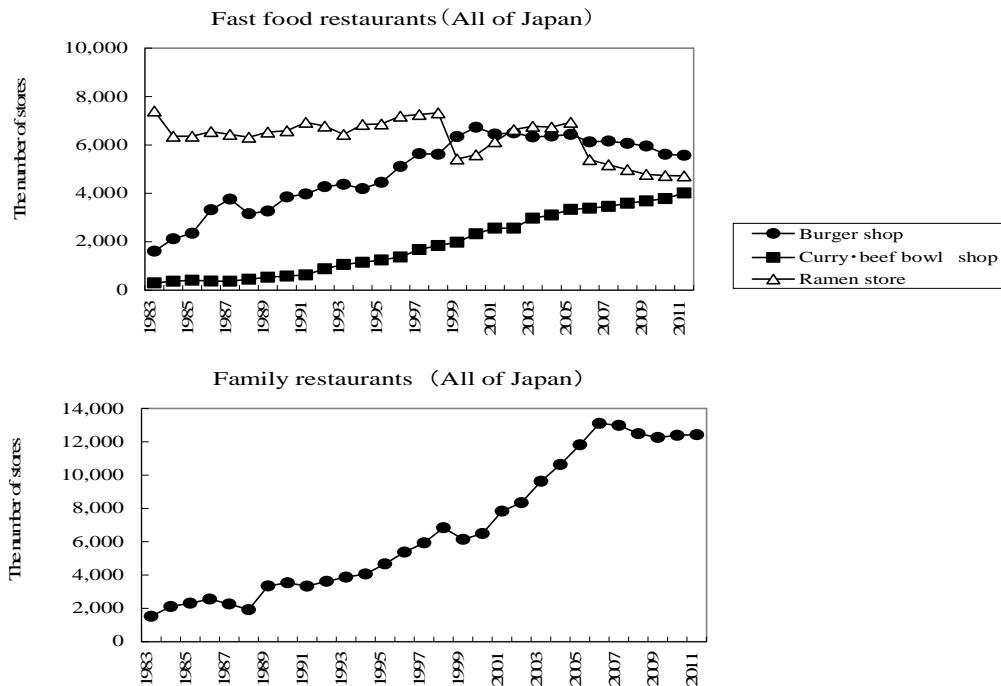
**Figure 6: Changes of the Number of Convenience Stores and General Merchandise Stores throughout All of Japan**



※Data Quoted from the Japan Franchise Association (<http://www.jfa-fc.or.jp/particle/19.html>), Monthly convenience store (2004).

For fast food restaurants, burger shops rapidly increased in the early 1980s to 2000s, and curry and beef bowl shops increased since the 1990s (Figure 7).

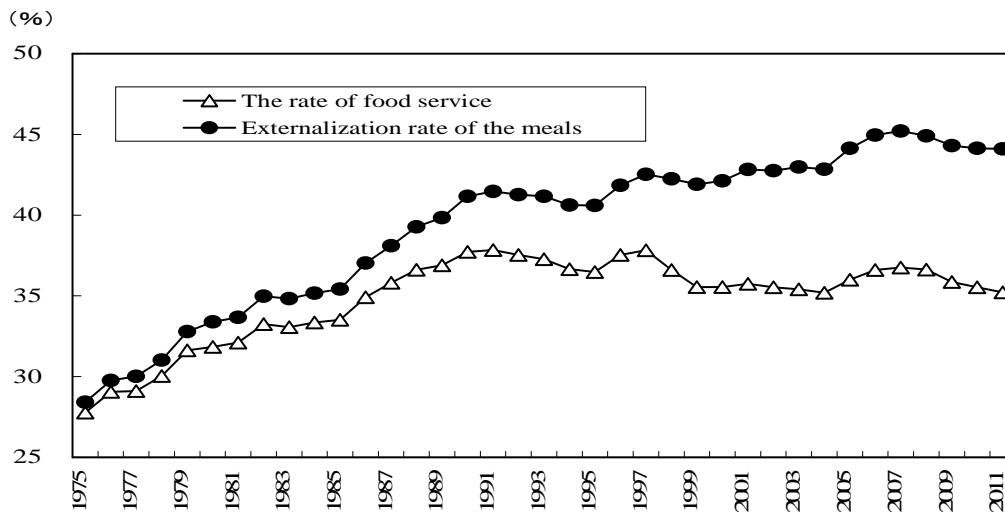
**Figure.7: Changes of the Number of Fast Food Restaurants and Family Restaurants throughout All of Japan**



※ Data Quoted from the Japan Franchise Association(<http://www.jfa-fc.or.jp/particle/19.html>)

The rate of food service increased in 1975-1990 followed by maintenance of a nearly parallel state, and the externalisation rate of meals has increased since 1975. However, food store information for Chiba Prefecture was not described (Figure 8).

**Figure 8: The Rate of Food Service and Externalization Rate of Meals throughout All of Japan.**

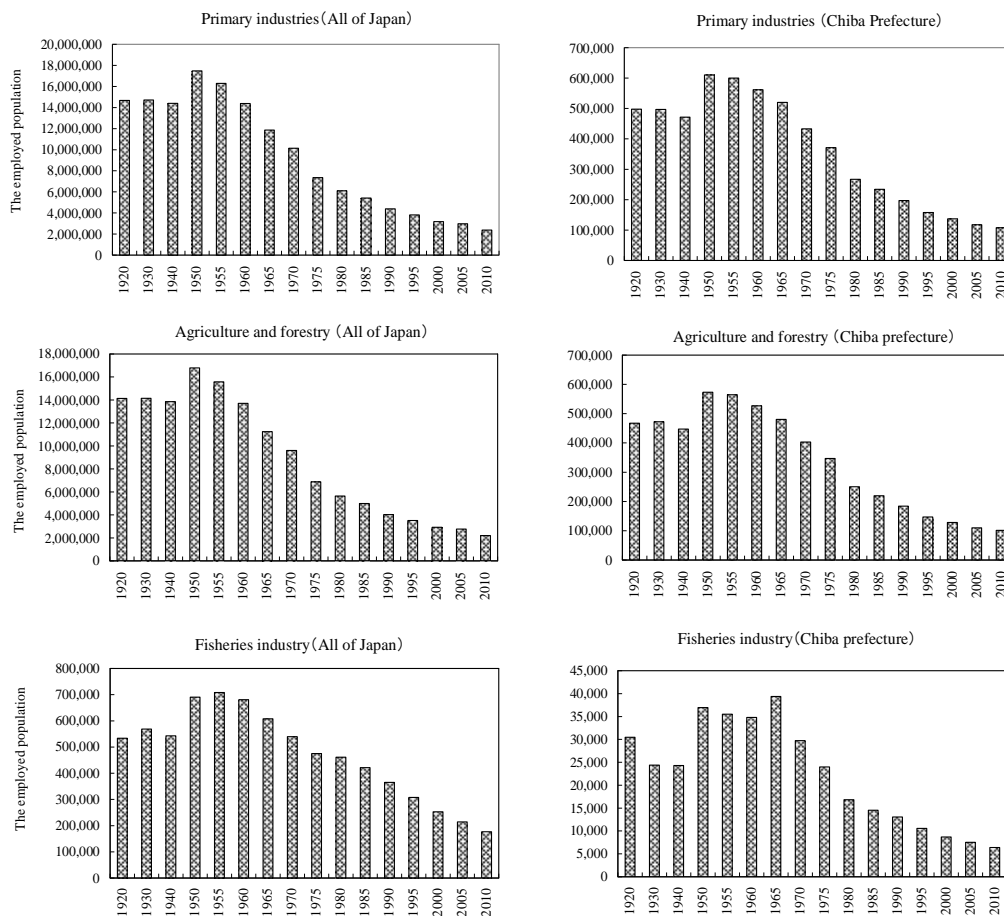


※ Data Quoted from the Foundation of Food Safety and Security (<http://anan-zaidan.or.jp/data/>).



With regard to the employed population of primary industry (agricultural and fishery industries) involved in food production in Japan, agriculture and forestry industries rapidly decreased after they peaked in 1950 throughout all of Japan and Chiba Prefecture. Moreover, the fishery industry has rapidly decreased since 1955 throughout all of Japan, but it peaked in 1960 in Chiba Prefecture. Moreover, the tendency of self-sufficient production decreased (Figure 9).

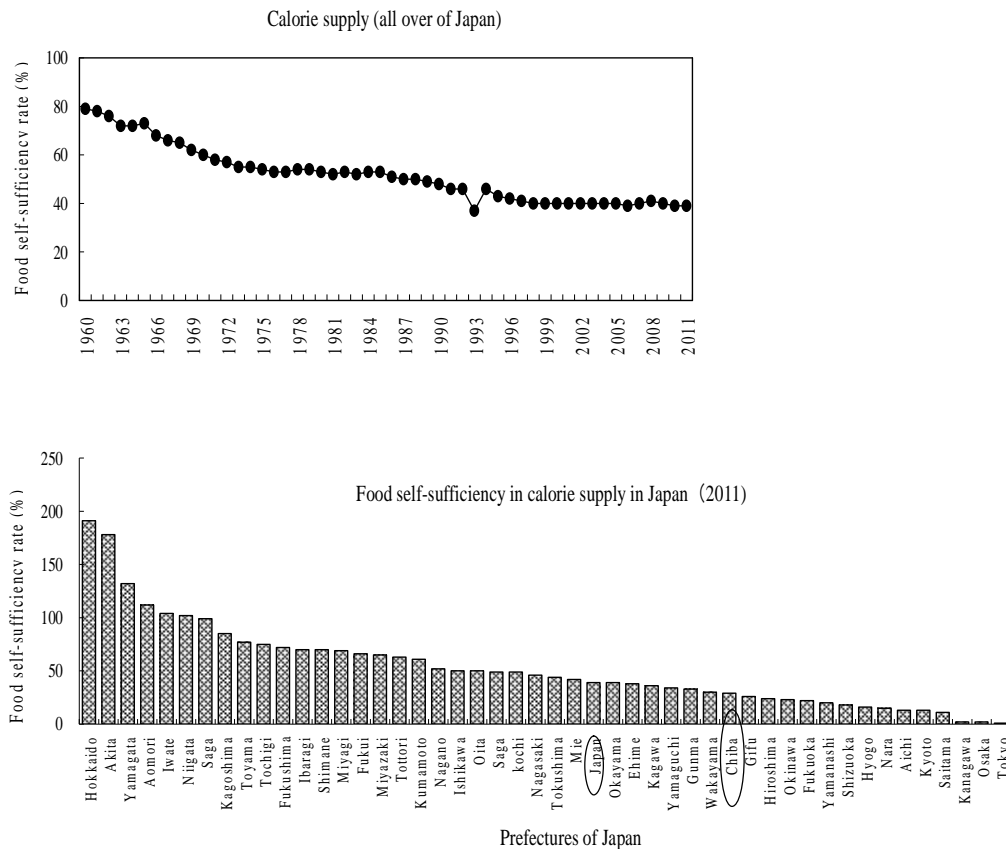
**Figure 9: Changes of the Employed Population of Primary Industries throughout All of Japan and Chiba Prefecture**



※ Data quoted from the Bureau of Statistics Office of Prime Minister Japan (1973), Statistical Survey Department, Statistics Bureau, Ministry of Internal Affairs and Communications Japan (2012, Chiba Prefecture (2011)).

The national average of the food self-sufficiency rate (calorie based) was nearly 80% in 1960, but it was reduced by half with a value of 39% in 2011. The food self-sufficiency rate in Chiba Prefecture was 29%, which was lower than the national average by 10% or more. According to rankings by prefecture for the food self-sufficiency rate, Chiba Prefecture was 33. In contrast, the food import volume was rapidly increased in 1960-1995, but it reached an equilibrium state at 1995, which was approximately 8-9 times higher than it was in 1960 (Figure 10).

**Figure 10: Food Self-Sufficiency Rate (In Calorie Supply) in Japan and the Ranking of Chiba Prefecture**



※ Data quoted from the Statistical Survey Department, Statistics Bureau, Ministry of Internal Affairs and Communications, Chapter7 Agriculture, Forestry and Fisheries (<http://www.stat.go.jp/data/chouki/07.htm>).

### 3.3. Change of Production Volume of the Central Ingredient of the Main Local Cuisine

The central ingredients of the main local cuisine in Chiba Prefecture are closely related the fishery industry, and the central ingredients include migratory fishes, such as sardines, pompanos, saury, bonitos, and tuna, as well as, shellfishes, such as littlenecks and turban shell (Table 1).

Table 1 The main local cuisine in Chiba Prefecture

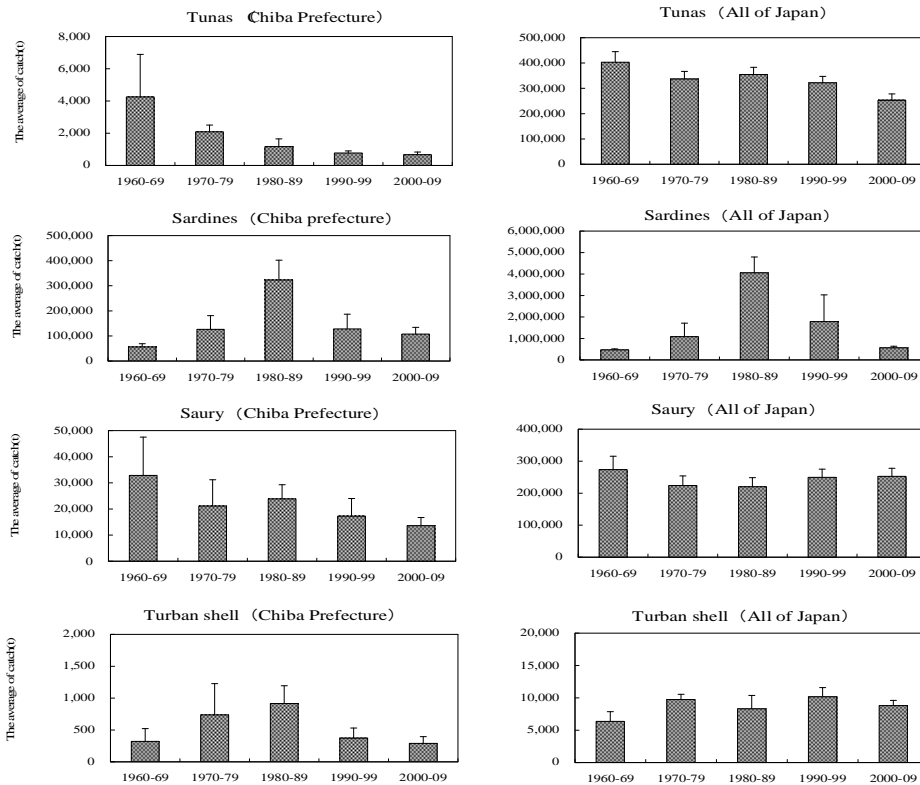
Dish name	Food ingredients	Dish summary
Sardine dish	Sadine, Anchovy, ect	Sardine dish is counted more than 100 kinds as sliced row fish, chopped fish, sesame pickle etc.
Saury dish	Saury	Grilled with salt, sliced row fish, etc
Finely chopped horse mackerel	Horse mackerel	Cooking pickled to vinegar Namerou
Bonito dish	Bonitos	Sliced row fish, hammering finish, bonito rice,etc
Turbo cooked in its own shell	Turban shell	This dish roast fire directly thrban shell, season with soy souce, and eat out after backed. The origin is unknown, but had appeared in the (1603-1867) Edo period.
Nuta of turban shell	Turban shell	Cooking mixed with mustard vinegared miso and vinegared miso the turban shell. Nuta means that reminds a marsh and field because miso source is semi-solid.
Magocha	Tunas•Bonitos	Chazuke using tunas and bonitos pickled soy souce.
Namerou	Horse mackerel,sardine, saury,mactra chinensis,etc	Cooking mixed with miso, ginger, chopped leeks and green perilla after chopped fish found in coastal waters of Sadine and hoese mackerel, etc. Raw fish dish that can be eaten without the soy sauce.
Sanga boil	Horse mackerel,sardine, saury,mactra	Cooking method was molded into a hamburger shape knead well Namero, and baked it.
Conger eel dish	Conger	Conger eel rice, Teppou boiled of conger eel etc
Manila clam dish	Manila clam	Manila clam rice, Manila clam spits etc
Mactra chinensis dish	Mactra chinensis	Sliced row fish, Tempura, Vinegared food

※ Data quoted from the hundred best local cuisines(Chiba Prefecture): <http://www.rdpc.or.jp/kyoudoryouri100/ryouri/12.html>.

With regard to the catch changes of these fishes and shellfishes (1960s-2000s), tuna gradually decreased in 1960-2000s in Japan, but it remarkably decreased in Chiba Prefecture. Saury was variable with gradual increases and decreases throughout all of Japan, but it remarkably decreased in the mid-1960s to 2000s in Chiba Prefecture. Conger had the record catch since 1990, but it was decreased during the 2000s throughout all of Japan and Chiba Prefecture.

Littlenecks decreased to approximately 25% in the 2000s in comparison to a peak in the 1970s throughout all of Japan, and littlenecks decreased to approximately 10% in the 2000s in comparison to a peak in the 1960s in Chiba Prefecture. Bonitos increased from 1960s to 1980s, but bonitos slightly decreased from a peak in the 1980s throughout all of Japan. Bonitos decreased in stages from a peak in the 1980s in Chiba Prefecture, and it was the lowest in the 2000s. Sardines decreased from a peak in the 1980s throughout all of Japan and Chiba Prefecture. Pompanos decreased from 1960s to 1980s but peaked in the 1990s followed by another decrease in the 2000s. Turban shell was variable with increases and decreases without a clear trend throughout all of Japan, and turban shell decreased from a peak in the 1980s in Chiba Prefecture. Consequently, the catch of fishes and shellfishes that comprise the ingredients of the local cuisine was decreased as a whole (Figure 11(1)-(2)).

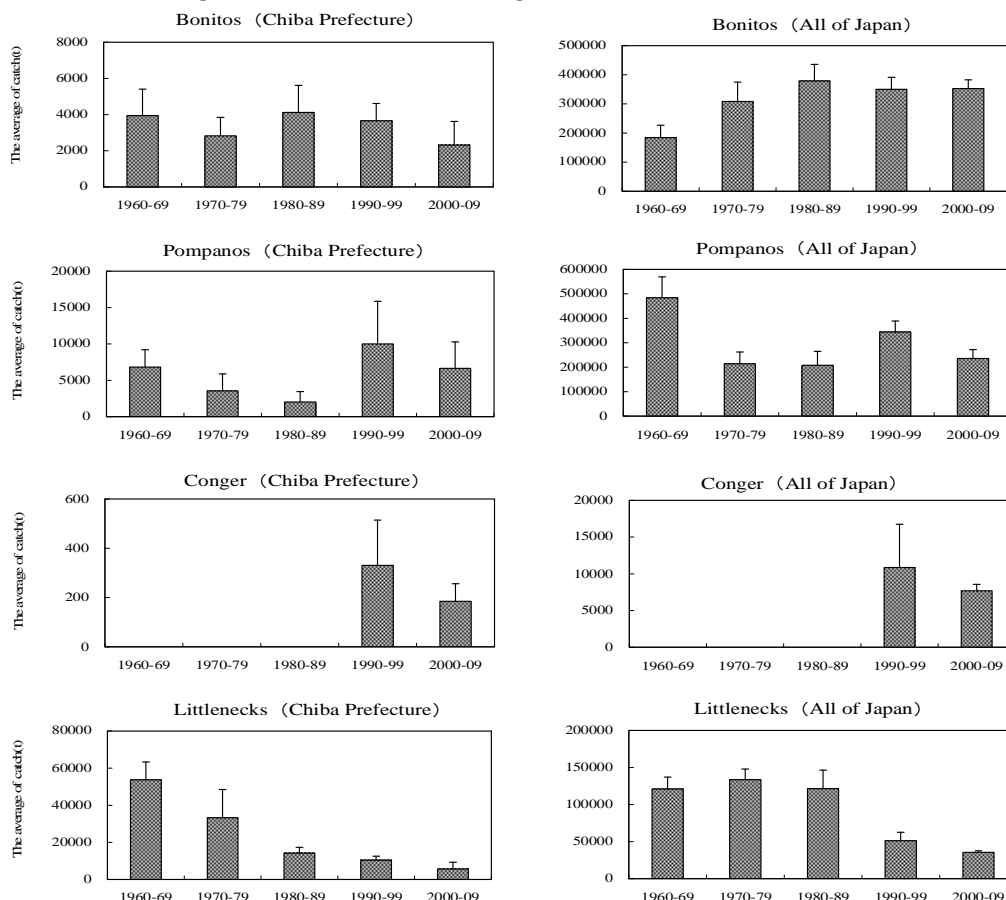
**Figure 11 (1): The Average of Catch Used for Ingredients in Local Cuisine (Fishes and Shellfishes)**



※Data quoted from the Agriculture, Forestry and Fisheries  
 ([http://www.maff.go.jp/j/tokei/kouhyou/kaimen\\_gyosei/index.html#1](http://www.maff.go.jp/j/tokei/kouhyou/kaimen_gyosei/index.html#1)),

Chiba Prefecture, Agriculture, Forestry and Fisheries Division, Fisheries Station (2012) and Ministry of Agriculture, Forestry and Fisheries Kanto Regional Agricultural Administration Office Agricultural Administration Office Chiba Department of Statistics (2007-2009).

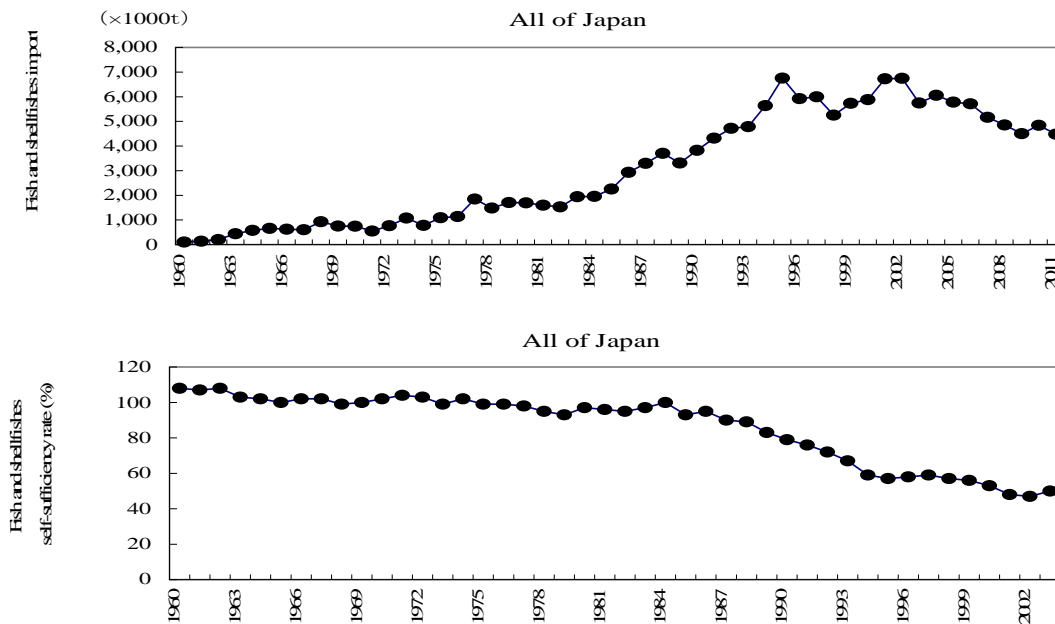
**Figure.11 (2): The Average of Catch Used for Ingredients in Local Cuisine (Fishes and Shellfishes)**



※Data quoted from the Agriculture, Forestry and Fisheries ([http://www.maff.go.jp/j/tokei/kouhyou/kaimen\\_gyosei/index.html#1](http://www.maff.go.jp/j/tokei/kouhyou/kaimen_gyosei/index.html#1)), Chiba Prefecture, Agriculture, Forestry and Fisheries Division, Fisheries Station. (2012) and Ministry of Agriculture, Forestry and Fisheries Kanto Regional Agricultural Administration Office Agricultural Administration Office Chiba Department of Statistics (2007-2009).

In contrast, although the food self-sufficiency rate of fishes and shellfishes was 100% or more until the mid-1980s, it decreased by up to 50% in 2003. In contrast, the import volume of fishes and shellfishes increased to 10 times or more from the 1960s to the mid-1990s, and then it had variable increases or decreases followed by a gradual decrease since 2000 (Figure 12).

**Figure 12: Food Import Volume, Fish and Shellfish Import Volume and Fish and Shellfish Self-Sufficiency Rate**

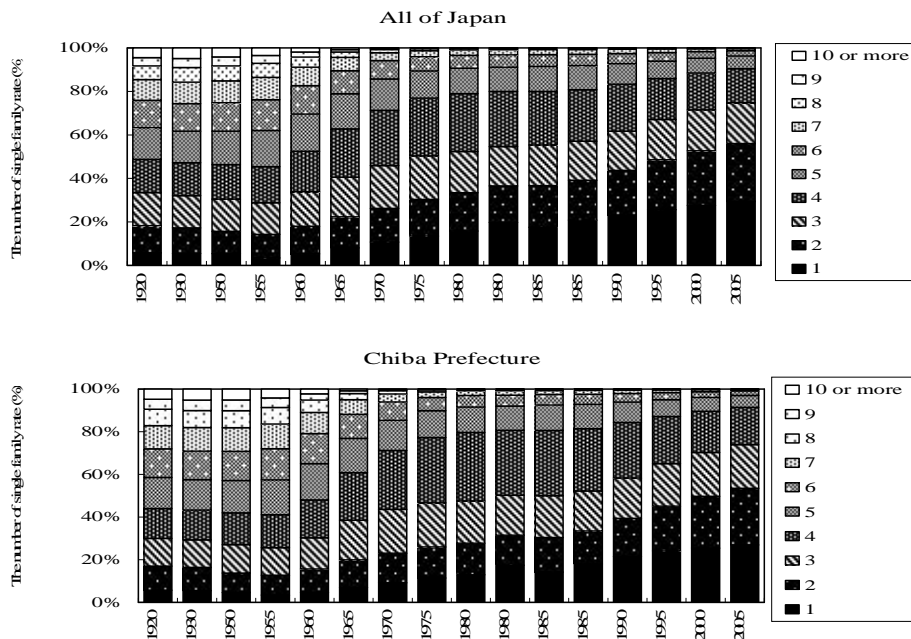


※ Data quoted Statistical Survey Department, Statistics Bureau, Ministry of Internal Affairs and Communications, Chapter 7 Agriculture, Forestry and Fisheries (<http://www.stat.go.jp/data/chouki/07.htm>), Ministry of Agriculture, Forestry and Fisheries (<http://www.maff.go.jp/j/tokei/kouhyou/zyukyu/#1>)

### 3.4. Change of family composition

The family composition changed from 1920 to 2005 throughout all of Japan and Chiba Prefecture. Although the family composition of 5 or more people per family was more than half in 1960 throughout all of Japan and Chiba Prefecture, the composition of 1-3 people per family later increased, and 70% or more of the family composition was a nuclear family in 2005 (Figure 13).

**Figure 13: The Single Family Rate throughout all of Japan and Chiba Prefecture**



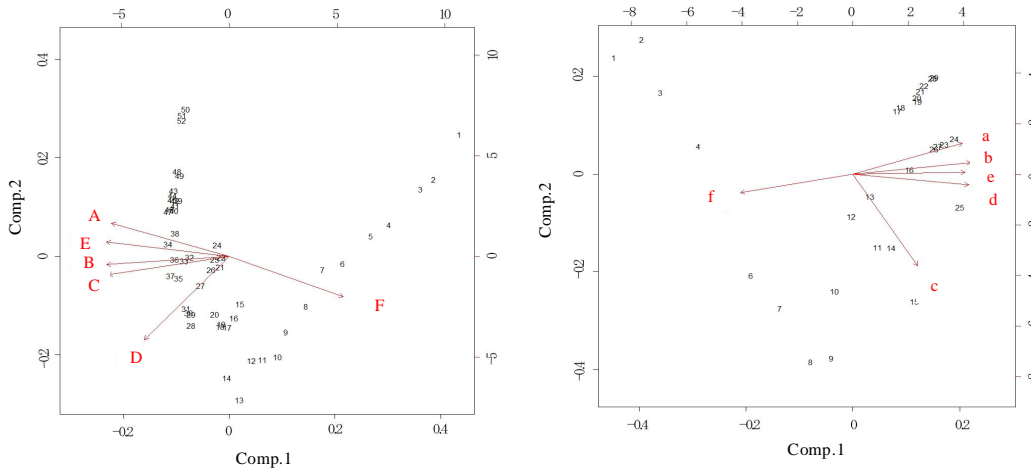
※ Data quoted from the Statistical Survey Department, Statistics Bureau, Ministry of Internal Affairs and Communications, Chapter 2 Population and Household, Agriculture, Forestry and Fisheries (<http://www.stat.go.jp/data/chouki/02.htm>)

### 3.5. Change of social situation and dietary life

Using principal component analysis, we analysed the influence of social situation changes (population growth, infrastructure development, and population growth) and dietary life changes (expansion of food service industry) on food self-sufficiency rate and food import volume. We divided the analysis into social situation and dietary life because the age of the data was not matched disallowing the analysis to be performed under the same conditions (Figure.14). As a result, the relationship between population changes and infrastructure development (improved and paved rates of roads; length of national expressways and railroads; number of new houses; number of integrating new houses; and actual GDP) had positive correlation coefficients for all items (significant difference;  $p < 0.01$ ) (Table 2).

Moreover, we used principal component analysis to analyse relationships with infrastructure development (improved and paved rates of roads; and number of houses). Because a part of the railroad and national expressway data was insufficient, it was not included in the item analysis. As a result, the food import volume increased with the expansion of infrastructure improvement, and the food self-sufficiency rate decreased. Moreover, the food import volume and the externalisation rate of meals increased with the expansion of the food service industry, but the food self-sufficiency rate reduced (Figure 14).

**Figure 14: The Relationship of Food Self-Sufficiency Rate and Infrastructure Improvement Using Principal Component Analysis**



Eigenvalue (Comp.1: 5.09, Comp.2: 0.76)

- A :Population
- B :The improved rate of road
- C :The paved rate of road
- D :The number of new houses
- E : Food import volume
- F : Food self-sufficiency rate

Eigenvalue (Comp.1: 4.84, Comp.2: 0.84)

- a :Family restaurants
- b :Convenience stores
- c :Restaurant industry
- d :The externalization rate of the meals
- e :Food import volume
- f : Food self-sufficiency rate

Table.2 The correlation of the increased population and infrastructure improvement, real GDP (All of Japan)

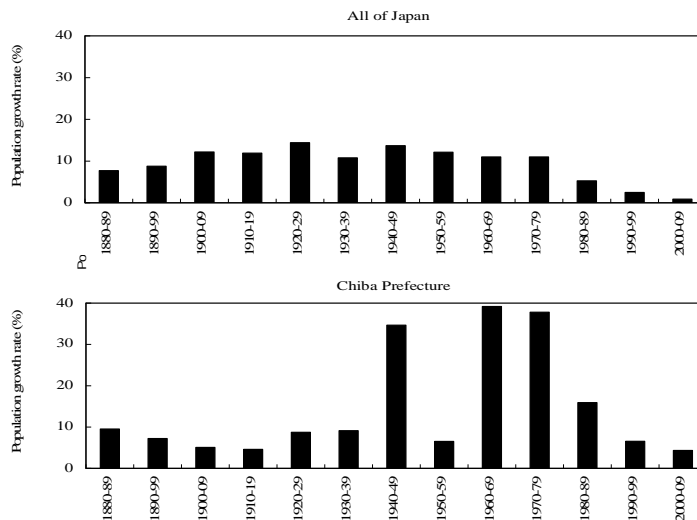
Item	Correlation coefficient	n	t
Improved ratio of the road	0.96	74	p<0.01
Paved ratio of the road	0.94	74	p<0.01
Total real length of national expressways	0.99	50	p<0.01
Total length of railroad	0.85	53	p<0.01
The number of integrating new house	0.97	53	p<0.01
Real GDP	0.99	57	p<0.01

**4. Discussion**

**4.1. Changes of Food Culture due to the Increased Population and Infrastructure Development**

The population growth rate throughout all of Japan was high in the 1900-1920s, 1940s, and 1950-1970s, and the population growth rate of Chiba Prefecture was high in the 1940s and 1960-1970s (Figure 15). We considered that the population changes were greatly affected by the evacuation during the world war II, the baby boom after world war II, and the high economic growth period of the 1960-1970s. Chiba Prefecture is a neighbour to the East of Tokyo, which prompted infrastructure development of roads, railroads, and new houses for living spaces for people to meet the demands of the increased population.

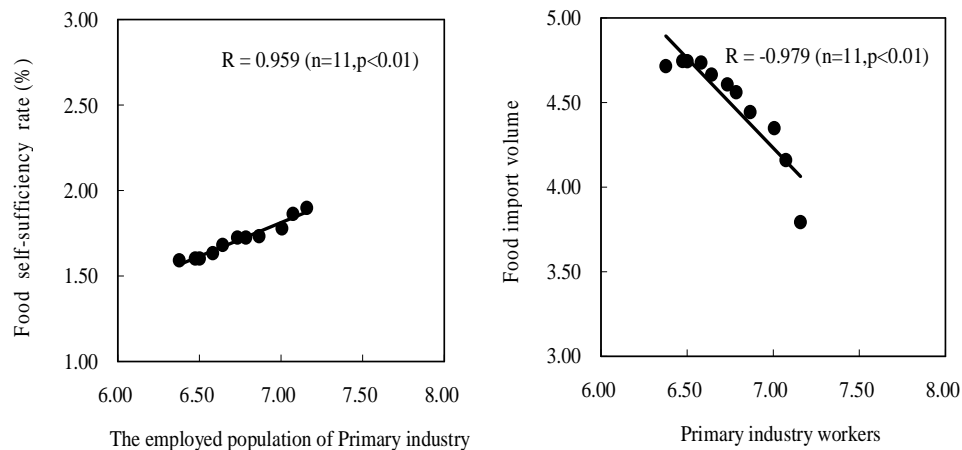


**Figure 15: Population Growth rate throughout all of Japan and Chiba Prefecture**

The relationships between population change and infrastructure development (improved and paved rates of roads; total length of national expressways; total length of railroads; number of integrating new houses; and actual GDP) throughout all of Japan, had positive correlation coefficients for all items (significant difference;  $p < 0.01$ ) (Table 2). We hypothesised that the development of roads and railroads as well as the expansion of new houses progressed with increased population. Although the number of food service industries of family restaurants, convenience stores, and general merchandise stores has increased since the 1980s, the food self-sufficiency rate in 2011 was decreased by half as compared to that of 1960 (Figure 6, 7, 10), and the food import volume increased (Figure 12). Moreover, the principal component analysis indicated that the food import volume and the externalisation rate of meals increased with the expansion of the food service industry, but the food self-sufficiency rate was low (Figure 14). Japan has the world's largest food import mileage (food import mileage is the result of multiplying the transport distance to Japan from the export country by the food import volume from the import partner country; the value was obtained from accumulating numbers) because the pattern of Japanese dietary life has largely changed in which a large amount of fat and animal products is consumed as compared to rice. To cope with this dietary life, it is necessary to supply a large amount of oil seeds for oil extraction and feed grains for livestock (Nakata 2003). However, Japan has depended on the inexpensive imports from overseas because these products have a relatively high cost of production due the land use need for these crops for a nation occupying a narrow strip of land.

With regard to the relationship of food self-sufficiency rate with food import volume and the employed population of primary industry, the food self-sufficiency rate indicated a positive correlation with an increase of the employed population of primary industry (significant difference;  $p < 0.01$ ), but the food self-sufficiency rate indicated a negative correlation with the food import volume (significant difference;  $p < 0.01$ ) (Figure 16).

**Figure 16: The Relationship of Primary Industry Workers, Food Self-Sufficiency Rate and Food Import Volume**



**Ichikawa (1988)** reported that the high speed and large amount of motor transportation made possible by the expansion of the national expressway network, which supported the economic growth of Japan, as well as the development of the national expressway improved the efficiency of wholesale and transport in addition to changing the distribution function. Moreover, supermarket and general merchandise stores expanded into regional hub cities, and employment opportunities increased in the areas due to the development of agriculture, industry, and commercial tourism, which helped to establish the population and enhance the economy.

Consequently, we considered that the change of food culture in Japan has largely influenced the development of the physical distribution system due to improving social structure, such as roads (in particular, the national expressway), as well as residences by expanding the economic development. Moreover, the population increased after World War II, and the food import volume from domestic and foreign sources has increased. In addition, the nuclear family has progressed (Figure 13). Thus, the traditional food culture of the region has weakened, and the westernisation of food has progressed. Furthermore, the employed population of primary industry has largely decreased because industry in Japan has converted to second and tertiary industry with economic development.

#### 4.2. Current Situation of the Main Ingredients of the Local Cuisine in Chiba Prefecture

Sea waters of Chiba Prefecture are located between the Kuroshio warm current (Japan current) and the Oyashio cold current (Tushima Current). This area is a prosperous area for fishing with resources that include both cold-water fishes (e.g., saury) and warm-water fishes (e.g., bonitos and sardines). The local cuisine focuses on fishes and shellfishes, such as sardines, saury, and bonitos (Table 1). However, with regard to the catch of fishes and shellfishes in Chiba Prefecture, tunas and saury decreased after the peak in the 1960s, and bonitos, sardines, and turban shell decreased after the peak in the 1980s. Moreover, in Chiba Prefecture, pompanos and conger decreased after the peak in the 1990s or later. On the other hand, the catch of tunas, saury, and bonitos throughout all of Japan was increased and decreased contrasting the change of catch in Chiba Prefecture (Figure 11). Moreover, the changes of import volume of fishes and shellfishes increased by 10 times or more from the 1960s to the mid-1990s followed by both increases and decreases.

With regard to the change factor of the fish and shellfish catches mentioned above, the bone of tunas was found in the stratum from 5,500 years ago (BC 3,500) in Torihama, in the kitchen midden of Fukui Prefecture (**Morikawa 1993**), and in the Sannai Maruyama ruin in Aomori Prefecture around the same period (BC 3,500-2,000) (**Sakai 2007**).

Consequently, there is a history of food use of tuna since 5,000 or more years ago in Japan, and the spread of the food use of tuna began from zuke, which was Nigiri zushi (it was soaked in soy sauce to store the fish as sushi) in the Edo period (1603-1867). However, it has become possible to supply the market without compromising the quality of tuna by the progress of refrigeration technology and distribution as well as the progress of the westernisation of food due to Japanese, i.e., because Japanese started to prefer flavoured food. The demand for tuna was high, and the price was low resulting in the catch rate of tuna to become largely increased. However, Tuna had to be imported from other countries because the catch in the fishing waters around Japan was not enough (**Ikeda 2005**).

Bone of bonitos was found from the stratum of the Jōmon period (14,000 BC–300 BC). Bonitos have been eaten since a few thousand years ago when the fishery was located in the Kuroshio current.

However, at present, the catch of bonitos in the Kuroshio current has decreased. In particular, off the coast of Boso in Chiba Prefecture, although fishing was at an active state in early spring to May prior to the 1980s, fishing was at an inactive state because fish were not caught recently. **Nihei (2006)** suggested that roundhaul fishing in South Korea, Taiwan, United States, and Philippines since the 1990s has caused a reduction of bonitos that migrate North using the Kuroshio current. Thus, we considered this possibility for tuna and bonito although the catch throughout all of Japan was not greatly decreased. However, the catch in the open ocean and that of Chiba Prefecture was decreased because tuna and bonito, which migrate North using the Kuroshio current, have been influenced by overfishing before reaching the Chiba waters. Saury is a pelagic fish that is widely distributed in the North Pacific Ocean, and it is an important resource that has been caught since the early Edo period (approximately 1670) (**Fukushima 1979**).

**Matsumiya and Tanaka (1978)** indicated that large annual variations of saury resources are related to the success and failure of re-production, and they suggested that the rapid decline of resources is not due to overfishing. Moreover, **Tian et al. (2002)** evaluated saury resources using a 10 year scale, and they confirmed the relationship with the regime shift due to the climate-marine environment, which greatly influences the resource variation. The rich and poor sardine catch periods of pilchard were described in the ancient documents of the Edo period in Japan (**Kawai 1989**). The increase and decrease in the catch was not caused by overfishing, and sardines expanded into the mixing waters from the Kuroshio region where they spent the transformation time from larvae to adult fish. It depends on whether can respond to the period to start a shoal of fish behavior similar to adult fish (**Watanabe 1996**), and **Matsuda (2001)** reported that the increases and decreases of the catch of pelagic fish, such as pilchard, have not been influenced by overfishing but that natural variation and environmental pollution have remarkably influenced pelagic fish. Moreover, the increase of horse mackerel after the decrease of pilchard is natural variation. With regard to the fish and shellfish catches throughout all of Japan and Chiba Prefecture, the catch of sardines decreased after the peak in the 1990s, the catch of pompanos increased, and the catch of saury decreased (Figure 11). Thus, pompanos may have been strongly influenced by natural variation, and saury may have been influenced by a large amount of catch in the non-fishing season.

Moreover, long-term variation of the pelagic fish resource, such as sardines, has been dominated by the climate and marine environment (**Francis et al., 1998; Beamish et al., 1999, 2000; Yasuda et al., 1994**). Other research reports have shown a relationship of global climate variation, such as the Aleutian low pressure and Niño, with the resource variation of catch species distributed widely in offshore areas, and these reports have suggested that the catch of pelagic fish has been largely influenced by the regime shift phenomenon based on the climate and marine ecosystem, which change in stages and discontinuous. (**Kawasaki 2003; Sugimoto et al. 2001**). Moreover, the regime shift is known to largely influence not only pelagic resources making migration difficult but also benthic fish resources with regard to the magnitude of the temporal and spatial scales (**Nihei et al. 2003**).

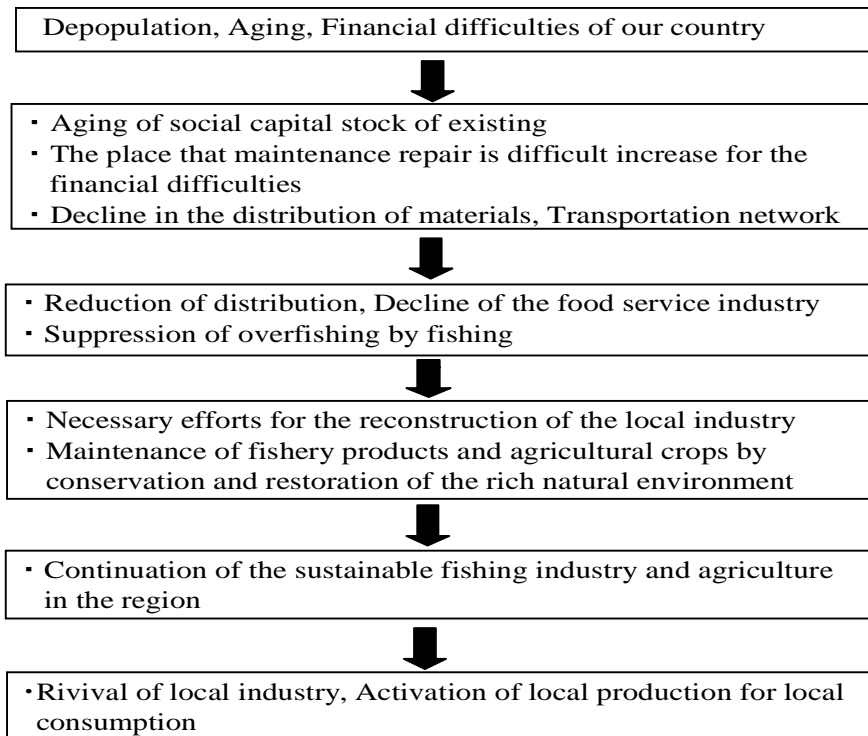
The benthic resource of balone and turban shell fluctuated in approximately 20 year units, and the Aleutian low pressure index also fluctuated in approximately 20 years units, which is an indication of large climate variation (**Minobe 2001**). In particular, the survival of spat of *Nordotis*, which has been caught in Chiba Prefecture, is due to the minus when the winter seawater temperature rises and the plus when winter seawater temperature decrease (**Kojima 2005**). The catch statistics of conger has been described since 1995, but there was no record for conger before 1995. The catch rate of conger became higher after fishing methods changed into tube fishing from long-line fishing. The catch of conger rapidly increased in the 1990s, but the catch of conger has decreased since 2000 (**Shimizu 2003**). Consequently, this result may be due to overfishing resulting from the efficient fishing method.

Overall, the increases and decreases of the catch of fish and shellfish have been affected by natural phenomena (periodic climate change) or overfishing. Thus, we hypothesise that there is a possibility that the catch will increase again. However, in the case of depletion due to overfishing, it is necessary to complete the catch management and the selection of target species using the "total allowable catch limit". Moreover, large-scale climate change due to global warming has progressed, and the change of ocean temperature and ocean current has affected spawning grounds and the habitat. Thus, the catch decreases due to fish species will be of concern for future decline and disappearance of local cuisine culture.

#### 4.3. Theme of the Future

For the future, the following changes of the social situation in Japan can be considered: population decline; aging; increase of the state financial shortages; reduction of maintenance; new development costs; decrease transportation use of roads and railroads; decline of transportation network; aging of social capital stock. In particular, because the provincial city is predicted to occur at an earlier stage than urban areas, the abovementioned phenomena have progressed. Thus, many restaurant industries, such as convenience stores and family restaurants, have decreased, and we anticipate that the food service industry and western food culture, which have expanded since the high economic growth period, will decline. However, the significance of local cuisine using regional ingredients should be considered and may lead to local production for local consumption, thereby restructuring local industry and inducing regional revitalisation. Consequently, our theme in the future is to continue activities in conservation and restoration of natural environment in the region in addition to largely reducing the living area due to human aging and population decline. Moreover, the theme will be to reconstruct traditional culture that is in harmony with the rich natural resources of the region to allow the culture to be inherited to the people of the next generation. If it is possible to minimise the damage from global warming on the agriculture and fishery industries, we will be able to continue to protect the traditional culture of the region, such as the local cuisine (Figure 17).

**Figure 17: Future Challenges to be addressed**



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