

Regions in Affected Areas: regional divisions of the East Japan Earthquake Disaster

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A geographical outline of Eastern Honshu was presented, mainly concerning to the Pacific coast suffered from severe tsunami disaster.

1. Outline of the affected region

The 2011 East Japan Disaster gave enormous damages especially in the Pacific coast of east Honshu, the main land of Japan, as shown in the beginning chapter. In this chapter, the author will give a brief description about its geography aiming to let the region known for the world readers.

Fig.1 outlines the location of the affected area with geomorphology, Prefectural boundary, major cities, and the arterial transportation networks of Shinkansen and highways in relation to Tokyo. Six northern prefectures in the map constitute the Tohoku Region and the southern seven prefectures including Tokyo constitute the Kanto Region. The three heavily affected prefectures of Iwate, Miyagi and Fukushima are 150 - 500 km north of Tokyo and takes about 2 hours on Shinkansen to Sendai, the regions dominant city. The Fukushima Daiichi Nuclear Power Station is 200 km north of Tokyo and 100 km from Sendai.

Table 1 summarizes industries in five



Fig.1 Eastern Honshu and its sub-regions along the Pacific coast

severely affected prefectures along the Pacific coast. The five prefectures' shares to the national total are: 11.6% of population, 12.0% of manufacturing shipment, 17.1% of agricultural shipment, 20.1% of marine fishery production, 17.8% of mariculture's production. These affected prefectures have totally large outputs from agriculture, marine fishery, and mariculture relative to the share of population. But Ibaragi and Chiba Prefectures also have significant share of manufacturing shipment, because they have major industrial complexes in coastal areas.

Table 1 Population and industrial production of the five prefectures containing severely affected area

Prefecture	population		manufacturing		agriculture		marine fishery		mariculture	
	2010		2010		2008		2008		2008	
	×1,000	%	billion yen	%	billion yen	%	1,000t	%	1,000t	%
Iwate	1,331	1.0	2,099	0.8	244.5	2.8	153	3.5	63	5.5
Miyagi	2,348	1.8	3,569	1.4	187.5	2.2	260	5.9	120	10.4
Fukushima	2,029	1.6	5,096	1.9	250.5	2.9	101	2.3	1	0.1
Ibaraki	2,969	2.3	10,846	4.1	428.4	5.0	191	4.4	0	0.0
Chiba	6,217	4.9	12,381	4.7	421.6	4.9	176	4.0	19	1.7
sub total	14,893	11.6	33,991	12.9	1,532.5	17.7	880	20.1	203	17.8
Japan total	128,056	100	262,850	100	8,650.9	100	4,373	100	1,146	100

source : Population Census, Statistic Table of Manufacturing, Production Statistics for Fishery and Aquaculture

As shown in the previous chapter, the heavily damaged areas mostly located along the Pacific coast which severely hit by huge tsunami. It means that every region in the five prefectures got evenly damaged. But intensive shock of M 9 mega-earthquake, resulted interruption in traffic and electric supply, and subsequent nuclear accident were commonly shared experiences among the five prefectures. It would therefore be proper view that every day lives of the people and every industrial activities in almost whole area in five prefectures got significant damages at least in the relieving period after the disaster.

2. Sub-regions in the Pacific side of eastern Honshu

Nevertheless the intensity of damage was unprecedentedly extensive and enormous especially in the costal area affected by tsunami. So the author will present commonly known sub-regions related to the coastal area in eastern Honshu.

As indicated in Fig.1, the coastal area can commonly be divided into three regions, Sanriku Coast, Sendai Bay Coast, Fukushima Hamadori Region, and East Kanto Coast based on natural, historical and economic characteristics. The tsunami affected the entire coast of these area.

1) Sanriku Coast

Sanriku Coast is called as “Rias” coast with indented coastline and limited flat lands which is

similar to that of the Ria coast in northwestern Spain. It is typical in south of Miyako as shown in Fig.1 and enlarged map of Fig.2 which shows such shape clearer.

While remote from the main transport networks, Sanriku Coast is suited to seaport with calm inlet, of which offshore sea is rich fishing ground. Owing to such location, some major fishing ports developed as bases of the boat fishery from inshore to offshore. The cities of Hachinohe, Miyako, Kamaishi, Ofunato, Kesen-numa, Shizugawa, Onagawa, Oshika, and Ishinomaki developed as such base ports. Among them, Hachinohe, Kesen-numa, and Ishinomaki are three biggest port cities not only in Sanriku Coast, but also in Japan. They are famous for their industrial complexes for fish processing. In addition, aquaculture of oyster, scallop, “wakame” seaweeds, kelp, and silver salmon are thriving in inlets and inshore sea of Sanriku Coast.

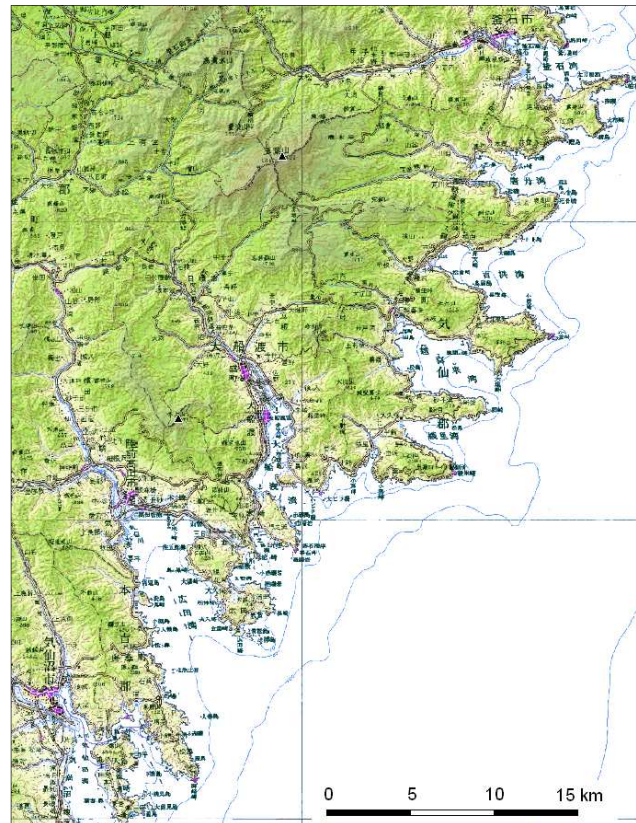


Fig.2 Typical “Rias” type of coast in Sanriku Coast (from Kanamishi to Kesen-numa)
Entire area along the coast suffered from devastate damages by tsunami on March 11, 2011.

At the same time, such shape of coastline inclines to amplify the intensity of tsunami, which was caused by sudden thrust of the Pacific plate submerging at the Japan Trench running parallel to Sanriku Coast. Owing to such tectonic position, Sanriku Coast suffered from twice of severe tsunami disasters after the Meiji Restoration in 1868.

Countermeasures against the expected tsunami had been in place, but the wave height this time exceeded well beyond the supposition, and thus every fishing port and coastal village witnessed the most severe human losses and physical damages in Japan’s history (Fig.3).



Fig.3 Devastated port town of Onagawa (April,3 2011) Three-storied buildings even fell down.

2) Sendai Bay Coast

Sendai Bay Coast stretches along the southeastern shore of Miyagi Prefecture (Fig.1,4). Based on the geomorphologic feature, its coastal area can be divided into several sub-sections; Ishinomaki Plain, Matsushima Bay, Sendai Plain, Natori Plain, and Watari Plain as shown in Fig.4.

Originally there stretched swamplands in the coastal plains, most of which were developed as agricultural lands mainly in the Edo era (17-19 Century). Among them, coastal area of Watari Plain has developed as one of the most thriving strawberry producer in Tohoku after Japan's rapid economic growth in 1970's. In the same period, new industrial ports were developed on the sand beaches near cities of Sendai and Ishinomaki as distribution bases for the commodities and industrial resources.

Well known tourist spot of Matsushima Bay is located in the middle of coastal plains, embracing many small islands thriving on aquaculture of oyster. At the western end of Matsushima Bay, port city of Shiogama is located, which is one of the biggest unloading port of fresh Tuna caught by inshore fishery.

Huge tsunami reached up to 3 - 5 km inland throughout Sendai Bay area but for Matsushima Bay (Fig.5), affecting many agricultural lands, coastal settlements and industrial estates.

In addition, powerful earthquake gave

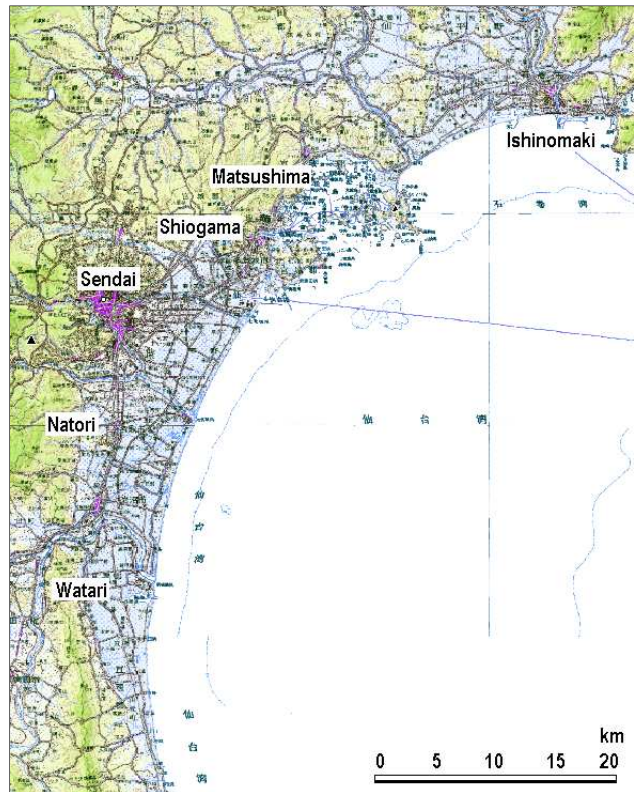


Fig.4 Sendai Bay Coast

Coastal plains here were inundated by tsunami up to 4 or 5 km from shore line

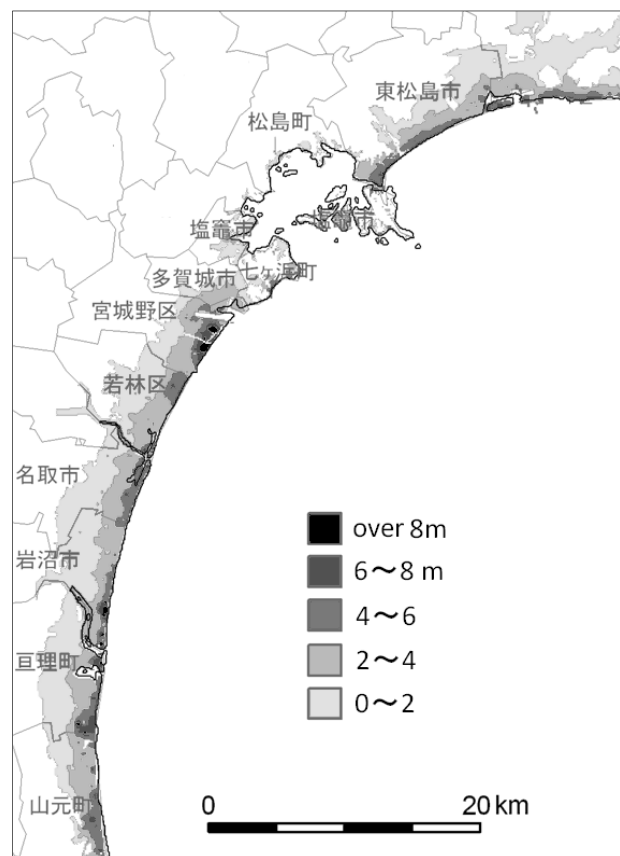


Fig.5 Depth of inundated tsunami flow

www.bousai.go.jp/jishin/chubou/higashinihon/7/sub8.pdf

damages especially on the logistics hub of Tohoku Region mainly situated in the coastal plain of Sendai and its suburbs, affected entire distribution economy of Tohoku Region.

4) Hamadori Coast

The Pacific coast of Fukushima Prefecture is locally called as “Hamadori”, consisting from the north of Soma, Futaba, and Iwaki regions (Fig.6). Most of the population and industries distribute along the national road 6 running through lowlands sharply cut by Futaba active fault from Abukuma Highlands in the west. The lowlands are consisted actually by terraced lands and fluvial plains along small rivers flowing down to the Pacific Ocean. Owing to narrow habitable area, density of population and industrial activities is limited, except for Iwaki region which was once major supplier of coal to main industrial areas in Kanto and now has many kinds of industries taking advantage of easy access.

As for the fishery, Harakama and Onahama have fishing base port for offshore fishery and Uketo is a local fishing port. A beautiful lagoon of Matsukawaura is known as laver (“nori” in Japanese) cultivation. But output of marine products is far limited in comparison with Sanriku Coast. A straight coastline unsuitable for the development of big base ports should be one of historical factors for it.

Distinctiveness of Hamadori’s industry is the location of power generation plants, containing four thermal and two nuclear power stations. Mountains are close in much of the coast and sea shore oriented industries did not develop. It resulted an economic structure that depends on the power generation plant of Tokyo Electric Power Company (TEPCO) who found this region suitable.

The tsunami affected Fukushima Nuclear Power Plant under crisis is situated in Futaba region. Most of Futaba region is within 30 km radius of Fukushima Daiichi Nuclear Power Station and under evacuation control even now. All of eight municipal authorities in Futaba moved their offices to other distant municipalities, and thus the whole regional society is under crisis.

5) Coast of East Kanto



Fig.6 Hamadori Coast
 ★ : nuclear power, ☆ thermal power

From a geomorphologic viewpoint, this area can be divided into four sections (Fig.7); Joban Coast, Kashima-nada Coast (both in Ibaraki Prefecture), Kujukuri Coast, and South Boso Coast (both in Chiba Prefecture). Among them, coasts of Joban and South Boso have ragged shoreline with some fishing and industrial ports. Coasts of Kashima-nada and Kujukuri have straight shaped sand beaches, but Kashima-nada Coast is interrupted by Kashima Industrial Complex developed since 1960's where some major plants making industrial materials located. At the location where Kashima-nada and Kujukuri Coast meets, Choshi City developed as one of Japan's major fishing ports.

In Joban Coast, many ports were affected by tsunami, but damage was rather limited to port area. In Kujukiri Coast, tsunami rose up to 7.6m in maximum at Iioka town where 13 persons were killed more than 700 houses were destroyed.

In East Kanto Region, liquefaction appeared vastly in almost every reclaimed land not only in coastal area but also in former swamplands inland (Fig.9). About 27,000 houses got such damages as ground subsidence and house leaning by the liquefaction in Kanto Region.★1 In Kashima Industrial Complex, many factories were interrupted their operations by liquefaction as well as inundation. Thus, liquefaction caused by the mega-earthquake of 2011 was believed as the largest one in world history of earthquake disaster.★2

3. Regional differentiation appeared in recent statistics on population and industry

Finally some statistical maps will be shown in order for the readers to grasp the local differences between the coastal and other areas more clearly based on what was described above. Fig.8 shows a distribution of population with its change ratio (2010), cultivated land (2009), and shipment value of manufacturing industry (2008) by municipality in five prefectures. Population distribution shows that coastal area in Hamadori and Sanriku are relatively less populated and industrialized than Kanto and arterial inland region where Shinkansen and highway run.

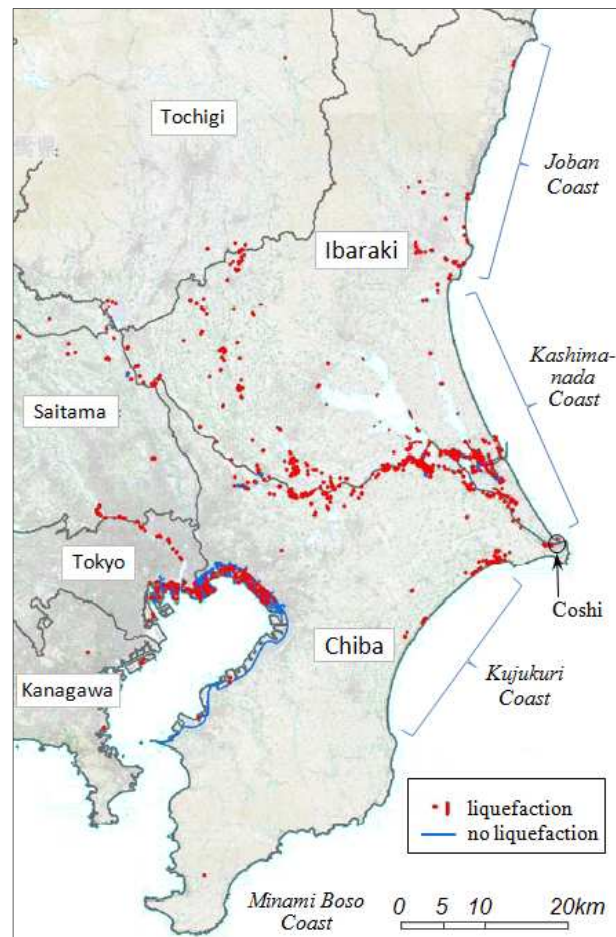


Fig.7 East Kanto and liquefaction
http://www.ktr.mlit.go.jp/ktr_content/content/000043569.pdf (modified by the author)

Especially rapid decrease of population and manufacturing industries and aging of population have continued since 1990's, that is the so-called "lost decade" of Japan.

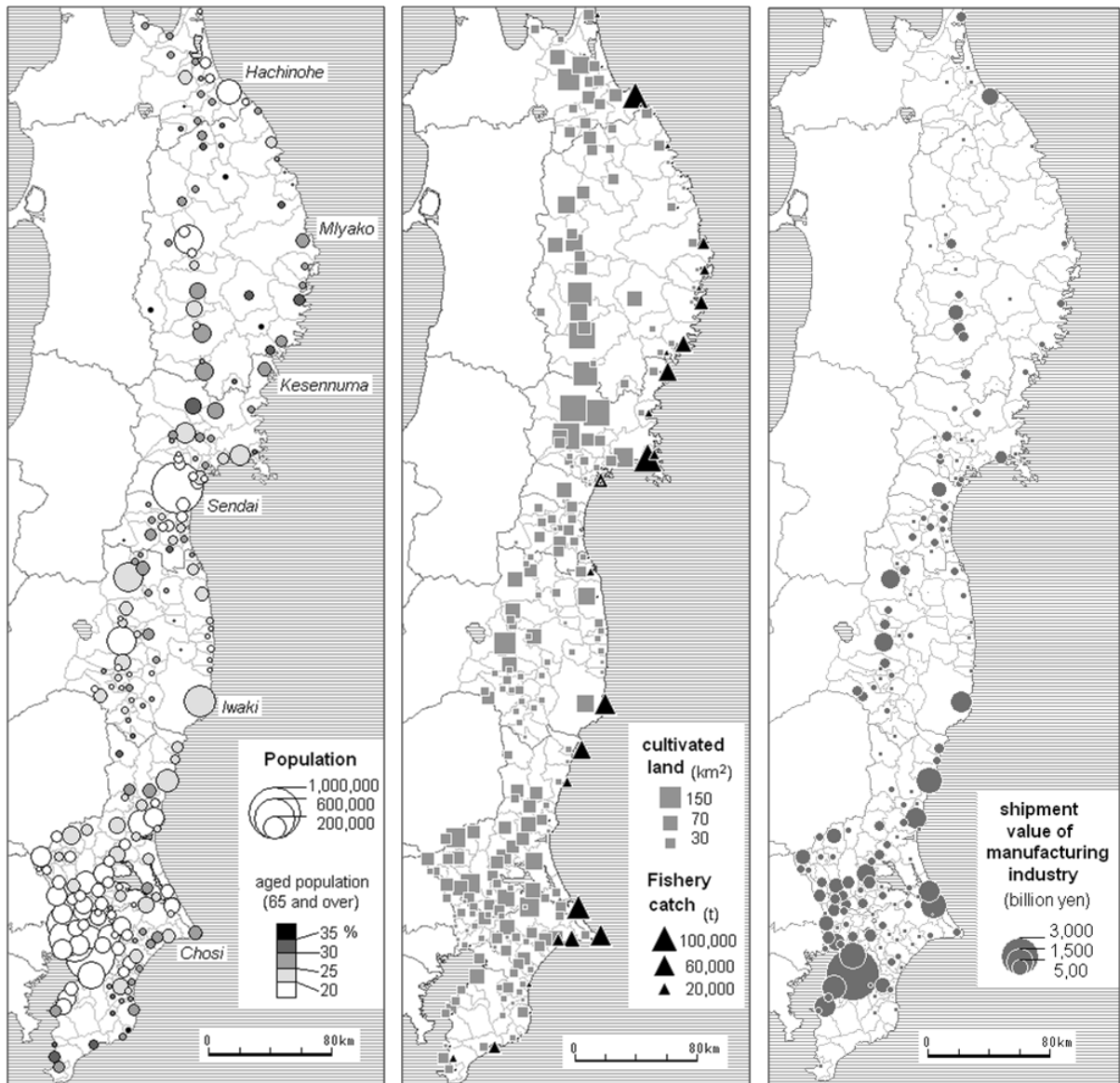


Fig. 8 Distribution of population with ratio of the aged (2005), cultivated land (2009), and shipment value of manufacturing industry (2008) by municipality in the Pacific side five prefectures

4. Prospect

In this chapter, a geographical outline of Eastern Honshu was presented, mainly concerning to the Pacific coast suffered from severe tsunami disaster. Many of the affected regions have faced severe situation even now with the delay of redevelopment measures especially in Sanriku Coast and unprecedented hard situation of radioactive pollution around the devastated nuclear power plant. Nevertheless, they must still play a important role in marine fishery of which products can make the variety of Japanese cuisine. Long time supports will be needed until their industries and everyday lives can recover.

Reference

★1 : Number of damaged houses is cited from Yomiuri Online, Jan. 12, 2012. Detailed reports of the liquefaction in Kanto Region are downloadable from following sites; <http://www.ishikawa-geo.or.jp/sitemap/img/higashinohon.pdf>, http://www.ktr.mlit.go.jp/ktr_content/content/000043569.pdf.

★2 : Nippon Keizai Shinbun, May 1, 2011