The Great East Japan Earthquake and Tsunami Records of Miyako City

Vol. 1, History of Tsunami (Summary Version)- English Edition

Miyako City Iwate Pref.

The Great East Japan Earthquake and Tsunami Records of Miyako City

Vol. 1, History of Tsunami (Summary Version)- English Edition

Description of cover photos

(Top from the left)

- Tsunami by the Sanriku Earthquake in 1896, at Hitachihama, Kuwagasaki
- Tsunami by the Sanriku Earthquake in 1933, at Taro Elementary School
- Tsunami by the Chilean Earthquake in 1960, at Current National Highway Route No. 45, Takahama

(Bottom)

- Tsunami by the Great East Japan Earthquake in 2011. View of Tsukiji from the City Hall (p. 8)

Foreword

Masanori Yamamoto, Mayor of Miyako City

In publishing *The Great East Japan Earthquake and Tsunami: Records of Miyako City. Vol. 1, History of Tsunami (Summary Version),* I would like once again to pray for the souls of those who fell victim to the tsunami disaster.

With more than three years having passed since the disaster of Mar. 11, 2011, I also wish to express my deep gratitude to people from the national government, prefectural government, municipal governments inside/outside the prefecture, and various organizations, as well as volunteers for the enormous assistance and cooperation.

Having formulated the Miyako City Great East Japan Earthquake and Tsunami Revival Plan in Jul. 2012, we at Miyako City are working for restoration with our three pillars of revival being "Restoration of Housing and Life," "Industrial/Economic Revival," and "Building Safe Communities." For "Building Safety Communities," which is one of the three pillars, we have defined "Succession of Memory of Disaster to Future Generations" as the direction of our work. We will preserve and compile records of the tsunami disaster and disseminate the information.

For contents of Vol. 1 (Summary Version), "Part 1: The Great East Japan Earthquake and Tsunami" contains *Special Photographic Issue: Tsunami* of the newsletter ***PR Miyako***, and various data on the Great East Japan Earthquake and Tsunami, such as a summary of damage by the earthquake and tsunami. At the end of the volume is a chronological report of earthquakes and tsunamis in the Miyako region, which has been compiled from various historical materials and documents.

As a corpus of records and data of tsunami damage in our City, I am sure that this volume will endure a long, effective use for study on development of disaster-resistant towns and awareness-raising/educational activities on disaster prevention.

In closing, I would like to heartily thank the members of the Miyako City Great East Japan Earthquake and Tsunami Records Editorial Committee, including Chair Yoriko Kanda and Vice Chair Masaaki Minami, for the kind services, as well as every individual from related organizations who provided cooperation in collecting materials and records.

Sep. 2014

Preface

Yoriko Kanda

Chair of the Miyako City Great East Japan Earthquake and Tsunami Records Editorial Committee
Professor, Faculty of Humanities, Keiwa Gakuen College

As we are going to press with *The Great East Japan Earthquake and Tsunami: Records of Miyako City*. Vol. 1, *History of Tsunami (Summary Version)*, I would like to pray for the souls of those who fell victim to the tsunami disaster. I would also express sympathy for people who are still having a hard time and pray that they can return to the normal daily life as early as possible.

My research has kept me connected to Miyako City for over 30 years. As many of my friends and acquaintances have suffered from the tsunami disaster, I have a personal feeling that the whole event is by no means unrelated to myself, which prompted me to participate in this project.

As a sequel to The Great East Japan Earthquake and Tsunami: Records of Miyako City. Vol. 1, *History of Tsunami*, the Miyako City Great East Japan Earthquake and Tsunami Records Editorial Committee plans to publish Vol. 2 of *The Great East Japan Earthquake and Tsunami: Records of Miyako City* in fiscal 2015. Mainly using the method of folklore studies, we interviewed people in various positions to learn how they acted when they were hit by the disaster, and their opinions backed by actual experiences as to how one should have acted and how they had wanted those around them to act. We listened to and put down their ideas on matters, such as how to respond in a disaster area and what the logistics support should be in an effort to record the experiences of people.

Our activities are not limited to putting down what we heard from people. Planning to insert personal accounts that have been already written by individuals, we are also collecting such writings. Furthermore, we wish to archive images (video footage and photos) of the days after the tsunami disaster for preservation as well. To this end, the editorial committee collects material not only together with many fellow researchers but also in collaboration with members of a local non-profit organization “Stand Up! Taro, Miyako” as well as members from the monthly town magazine *Miyako My Town*. We are making efforts in hopes that these Records will help Miyako City in overcoming this disaster and making itself a disaster-tolerant town.

Praying that everyone can return to the normal daily life as early as possible, we will continue our data gathering activities.

Hoping for Revival of Miyako City

Masaaki Minami

Vice Chair of the Miyako City Great East Japan Earthquake and Tsunami Records Editorial Committee
Professor, Department of Civil and Environmental Engineering, Faculty of Engineering, Iwate University

Three years have already passed since the Great East Japan Earthquake. The unprecedented disaster brought monstrous damage to Miyako City. Many precious lives were lost, numerous buildings and facilities damaged or carried away, and the townscape completely disfigured in some neighborhoods.

From that time on, people in disaster areas have undergone immeasurable suffering and moments of sadness in day-to-day life. Under such circumstances, residents, local administration, and supporters have held a number of discussions to envision and create a future life and townscape, formulating plans for revival and putting them into practice.

The principal task of compiling the history of Miyako City would be to capture as historical records how people in Miyako have endured sadness and are making progress to start a new life. These records will allow generations after generations to learn about the monstrosity of tsunami disasters, how to prevent/mitigate a tsunami disaster, how to build a disaster-tolerant town, and how to develop and implement revival plans. We will obtain irreplaceable wisdom as a person and as a society from the way people carve out their lives in the wake of this massive disaster.

These records will inform us about what preliminary measures to take with respect to major disasters that are expected to take place in our country at the level of individuals, households, local communities, urban infrastructure facilities, and legal systems, as well as about how to respond in the event of a recurrence of a major disaster. At the same time, these records will bring to our minds the sanctity of many people' s lives who fell victim to the Great East Japan Earthquake and Tsunami together with a prayer for the repose of their souls.

Due to my personal connection to Miyako for about 10 years starting before this tsunami disaster, I have been given a role in compiling the history of Miyako City. I have frequently visited with students for study purposes the Taro neighborhood renowned as the town of tsunami disaster prevention. We had surveyed the elevation of the land and the distribution of residents. We had just started in Jan. 2011 a project on tsunami evacuation exercises suitable for each individual with more than 100 residents participating in the project. The road to tsunami disaster prevention, which people of Miyako have been pursuing, continues onward. I sincerely pray that this continuous effort will bring wisdom and hope for mankind.

The Great East Japan Earthquake and Tsunami Records of Miyako City.
Vol. 1, History of Tsunami (Summary Version) -English Edition

— Table of Contents —

Special Photographic Issue

Document 2011.3.11

Tsunami

Records of Tsunami Disaster in Miyako City and a Step toward Revival

The tsunami this time destroyed many precious lives and valuable properties. We would like to express our deep sorrow over the departed and sympathy for city residents who have suffered from the disaster. PR Miyako has decided to publish a special photographic issue to pass down the post-disaster state of the City as is to future generations. May this volume help people turn despair into hope and make a step toward revival of this city!.

Photographers: Koji Fujita, Yoshiaki Kawauchi, Hiroaki Nakamura, Naomichi Nakamura (*PR Miyako*)
Photo contributors (without title): Miyako Fishery Cooperative, Taro-cho Fishery Cooperative, Hitoshi Maekawa, and Kaoru Wada

Records file 1

Urban Areas and Sokei

At 3:23 p.m. on Mar. 11. Black waves quickly grew in height, making a roaring sound as they poured into urban areas.

Status of Earthquake and Tsunami (according to a release by the Japan Meteorological Agency)

Date and time of the occurrence: at about 2:46 p.m. on Mar. 11, 2011
Epicenter: Off the Sanriku Coast at lat 38° 6.2' N, long 142° 51.6' E, about 130 km ESE of the Oshika Peninsula
Focal depth: about 24 km
Magnitude at hypocenter: a magnitude of 9.0 (interim value)
Seismic intensity: 5-upper in Moichi; 5-lower in Satsuki-cho, Kuwagasaki, Nagasawa, Taro, Kawai, and Kadoma Tashiro
Issuance of warnings and advisories:
At 2:49 p.m. on Fri., Mar. 11, 2011, Major tsunami warning for Iwate Prefecture
At 8:20 p.m. on Sat., Mar. 12, 2011, Downgraded to tsunami warning
At 7:30 a.m. on Sun., Mar. 13, 2011, Downgraded to tsunami advisory
At 5:58 p.m. on Sun., Mar. 13, 2011, Tsunami advisory canceled

Time of arrival/height of the first tsunami: at 2:48 p.m. on Fri., Mar. 11, 2011; 0.2 m
Time of arrival/height of the largest tsunami: at 3:26 p.m. on Fri., Mar. 11, 2011; over 8.5 m
*According to analysis of records at tsunami observation points recovered on-site at a later date.

(For reference) Tsunami run-up height: 37.9 m in the Koborinai neighborhood in Taro according to a release by Earthquake Research Institute, University of Tokyo
38.9 m in the Omoe Aneyoshi neighborhood according to a release by the Tokyo University of Marine Science and Technology

Status of Evacuation

Establishment of City Headquarters for Disaster Countermeasures: at 2:46 p.m. on Fri., Mar. 11, 2011
Closing of floodgates and sluice gates: 111 floodgates and sluice gates closed upon the issuance of tsunami warning (93 gates in the Miyako area, 18 gates in the Taro area)
Issuance of evacuation order: at 2:49 p.m. on Fri., Mar. 11, 2011
Cancellation of evacuation order: at 5:58 p.m. on Sun., Mar. 13, 2011
People subject to evacuation order: 5,227 households, 12,842 people
No. of shelters/evacuees: up to 8,889 individuals at 85 places

Special Photographic Issue December 2011 311 Tsunami Records of Disaster in Miyako and a Step toward Revival

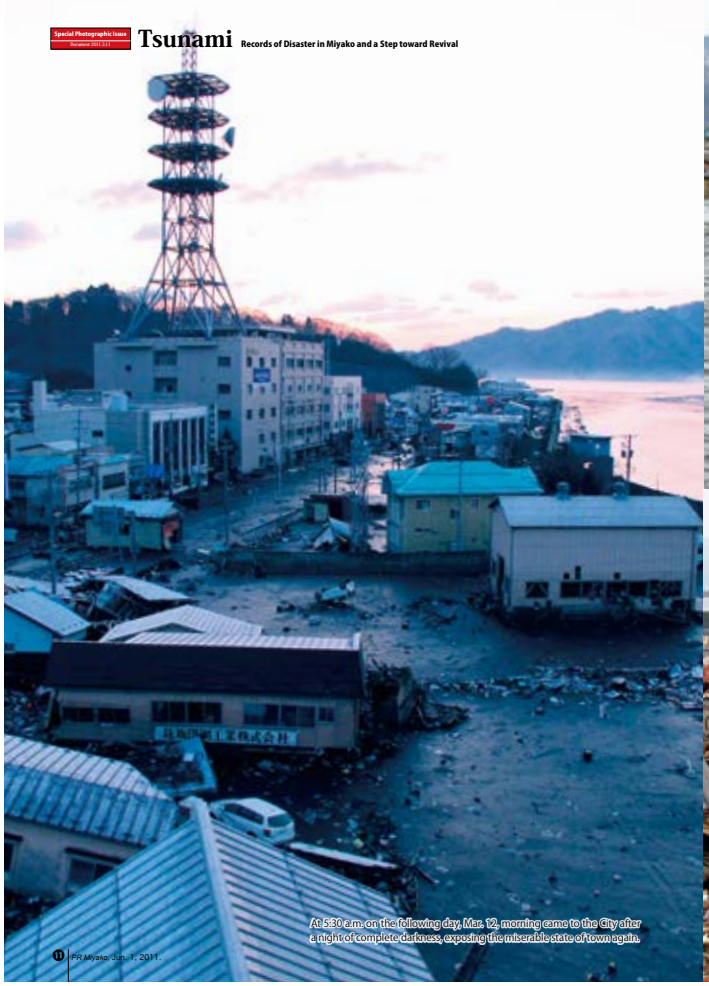
A submerged crossing in front of the City Hall. Horns of cars caught by waves kept sounding for a while before silence reigned over the place.

At 3:18 p.m. on Mar. 11. The Hei River with the bottom visible during an ebb tide. A fire engine ran along the dike calling for evacuation.

At 3:25 p.m. on Mar. 11. Seven minutes after the above picture with the water level rising above the dike, water violently poured into urban areas.

Like waterfalls, there was no stopping of a tsunami pouring into urban areas.

Special Photographic Issue
Tsunami Records of Disaster in Miyako and a Step toward Revival



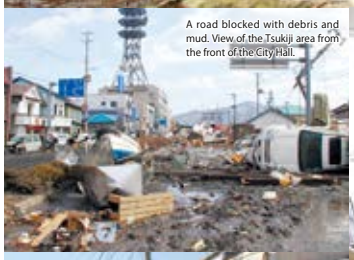
At 5:30 a.m. on the following day, Mar. 12, morning came to the City after a night of complete darkness, exposing the miserable state of town again.

The merciless tsunami hitting the Fujiwara area with big splashes

Disaster damage in the Koganji area adjacent to the dike

Rias Harbor Miyako destroyed by the tsunami much to the regret of those who had been preparing to host inter-high school sailing competitions.

A JR Yamada Line railroad bridge over the Hei River torn apart by the impact of the tsunami



A road blocked with debris and mud. View of the Tsukiji area from the front of the City Hall.

Countless cars and ships swept by water landed in urban areas.

The ravaged lobby on the first floor of the City Hall

Around a crossing in the Sokei/Kanbayashi area. Stranded ships commingled with destroyed houses.

Records file 2

Kuwagasaki

At Desaki Pier, fish market faulities, related materials, and vehicles were engulfed in waves one after another (photo courtesy of Miyako Fishery Cooperative).

View of Takonohama Town and Minato Town from the Jodogahama Bridge

Destroyed houses carried away to Miyako Bay by backwash
(photo courtesy of Miyako Fishery Cooperative)

Former fish market building. The force of waves carried up a car to land just below the arching ceiling.

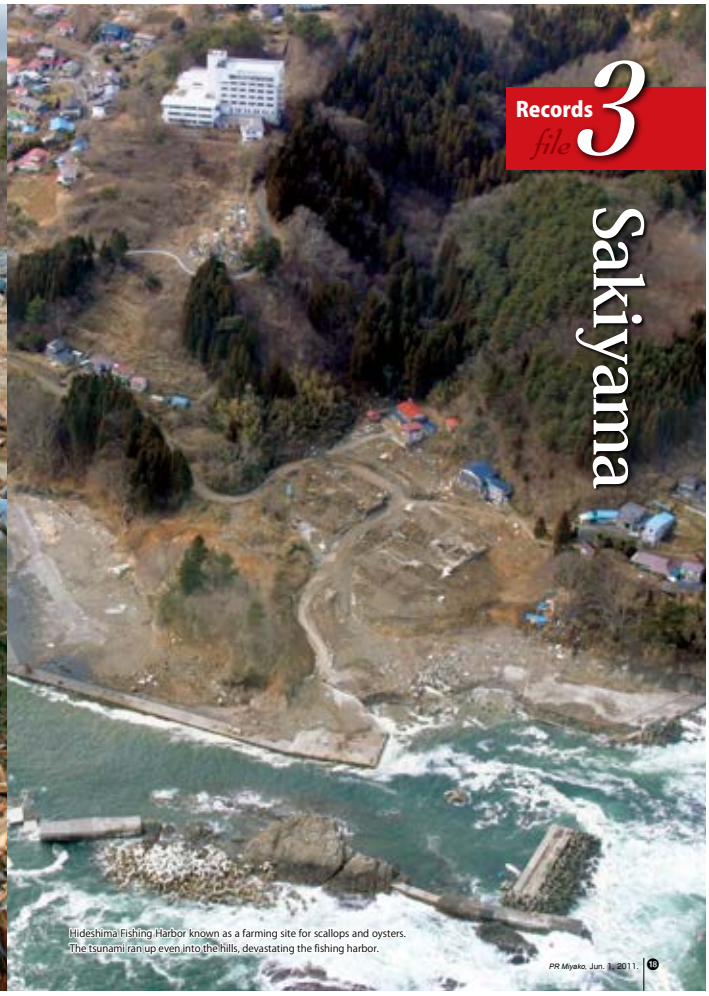
Despite the strenuous search conducted continuously by reinforcement teams from across the country, many precious lives were lost. A cruise vessel is stranded in the background.

Miyako Farming Fishery Center near Onatsupe Beach ruined by the force of the tsunami

In the Nakanohama area, tsunamis rushed to even the innermost part of the community to demolish houses.

Records file 3

Sakiyama

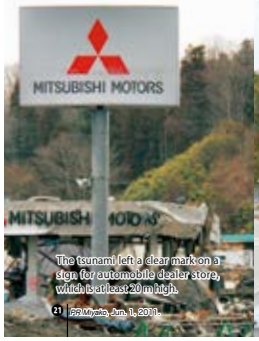


Hideshima Fishing Harbor known as a farming site for scallops and oysters. The tsunami ran up even into the hills, devastating the fishing harbor.

Records file 4

Takahama and Kanehama

In the Kanehama area, the entire community suffered devastating damage.



The tsunami left a clear mark on a sign for automobile dealer store, which is at least 20 m high.

Tsunami even rose up to the schoolyard of Takahama Elementary School on a hill. The fence fell to the seaside by the force of backwash.

Fishery farming buoys entangled with a sign for hotspring facilities

Tsunami ran up close to the Miyako Road on a hill. Photo taken with a mobile phone from a place about 400 m away from the Miyako-minami Interchange (photo courtesy of Kaoru Wada)

The Takahama area after the disaster. The tsunami that flew over the dike crossed National Highway Route No. 45 and poured into the community at once.

In the Kanehama area, the dike was broken so that the mouth of bay was seen.

The tsunami also crossed a JR rail track to hit an innermost community. Overturned rails show the force of tsunamis (Kanehama area).

Records file 5

Tsugaruishi, Akamae, and Shirahama

The Norinowaki neighborhood immediately along the Tsugaruishi River on the left bank and the Sakae-dori Street and Akamae neighborhoods on the right bank suffered devastating damage. The tsunami even reached areas far removed from the sea, such as Tsugaruishi Elementary School and Miyako Technical High School, to cause extensive damage.

The tsunami rushing into the schoolyard of Miyako Technical High School (photo courtesy of Hitoshi Maekawa)

Several minutes after the photo above. The entire place turned into the sea after a moment (photo courtesy of Hitoshi Maekawa).

The tsunami engulfed Miyako Athletic Park and struck the Akamae neighborhood. There is a municipal housing building overturned by the force of tsunamis in the background.

Railcars on the JR Yamada Line derailed by the force of the tsunami (at Tsugaruishi Station)

In the Norinowaki neighborhood, most of the houses in the community were demolished.

In the Shirahama neighborhood, the tsunami flew over the dike of the fishing harbor to destroy houses.

Debris removal operation by the Self Defense Forces (the Sakae-dori neighborhood)

Records file 6

Omoe

The Omoe neighborhood was home to quality seafood, such as sea urchins, ear shells, and wakame seaweed. The facilities of the Omoe Fishery Cooperative built at each fishing harbor were destroyed and fishing boats carried away. This photo shows the Otobe neighborhood after the disaster. Waves that directly hit the fishing harbor ran up to an innermost community to cause devastating damage.

Otobe Fishing Harbor. Facilities like the processing plant and pickup site were destroyed except for steel frames.

Omoe Fishing Harbor (in Sato). Facilities like the ice-making/refrigeration plant and seedling production facilities for ear shells were lost.

The Chikei neighborhood. The tsunami hit the fishing harbor and rose up to the level of Chikei Elementary School.

The tsunami broke down the Mukaiwatari Bridge over the Omoe Peninsula Line, obstructing traffic.

Records file 7

Taro

A wide range of the Taro neighborhood was devastatingly damaged. The huge dikes of Taro, boasting a total length of 2,433 m and a height of 10 m above the sea level, but the outer dike was destroyed by the tsunami this time.

With roads unavailable for traffic due to displaced houses and heaps of debris, residents used the track of Sanriku Railway for passage.

The tsunami flew over the huge dikes effortlessly to invade the land at a stroke (photo courtesy of Taro Fishery Cooperative).

Fire broke out after the onset of the tsunami one after another.

The Taro neighborhood turned into heaps of debris. Destroyed houses were carried up to the Taro Office Building of the City Hall (at the upper right).

On May 6, His Imperial Majesty and Her Imperial Majesty visited the Municipal General Gymnasium, one of the shelters in Miyako City. Their Imperial Majesties conversed with about 100 citizens who found shelter there, expressing sympathy in saying "How is everything?" , "Pleased to see you safe," etc.

Records file 8

A Step for Revival

Their Majesties the Emperor and Empress visited a shelter in Miyako

"Wish to provide enjoyment and vitality." The foundation for the Agriculture of Flowers and Greenery, gardening companies in Kushiro, Hokkaido, etc., brought ten thousand roots of flowers with which 150 volunteers decorated the city (on Apr. 16 at Miyako Station Plaza).

Fujiwara Pier served as temporary storage for destroyed vehicles.

Quick-fix temporary houses being built at a quick pace

View of Miyako Bay from Kuwagasaki Elementary School. Among heaps of debris, cherry blossoms silently tell the coming of spring.

"Wish to arouse fortitude by standing up again and again after falls." Kensuke Sasaki and his team held charity professional wrestling matches before tsunami victims staying at shelters. After the matches, Mr. Sasaki, his wife Akira Hakuto, and others gave presents like stationery to children (on May 4 at Furea Park).

"Let us tough it out with positive thinking to achieve restoration by all means." Former Giants baseball player Kiyoshi Nakahata and Kazunori Shinozuka cheered up people, presenting brand-new baseball gloves to children. Comedian Kunihiro Matsumura also joined in, creating laughter with his impressions of celebrities (on Apr. 26 at Green Pier Sanriku Miyako).

"It's tough, but let us hold on." Actor Ken Watanabe visited a shelter, giving soothing words to evacuees one by one (on May 4 at Daini Junior High School).

Self-Defense Force Bands held a concert at each shelter in Miyako. The band and audience came together as one to play music, shaking a handmade ball with a smile.

People at the Amenomori neighborhood in Nagahama City, Shiga, made a 50 m long giant carp streamer in prayer for revival. The carp streamer carried inscriptions: "Tough it Out, Iwate" and "Fortitude, Hope, Revival." At an event organized by NPO Theater Company You and related parties, the carp flew high above Miyako Bay (on May 11 at Fujiwara Pier).

"Grow big and return home safe"

Salmon return to their home river in about four years, overcoming various hardships on the way.
Amid remnants of debris, they swam down the Tsugaruishi River heading for the ocean.
The road to town revival is a long and steep journey.
Let all citizens join forces and make a step forward for a new Miyako City.

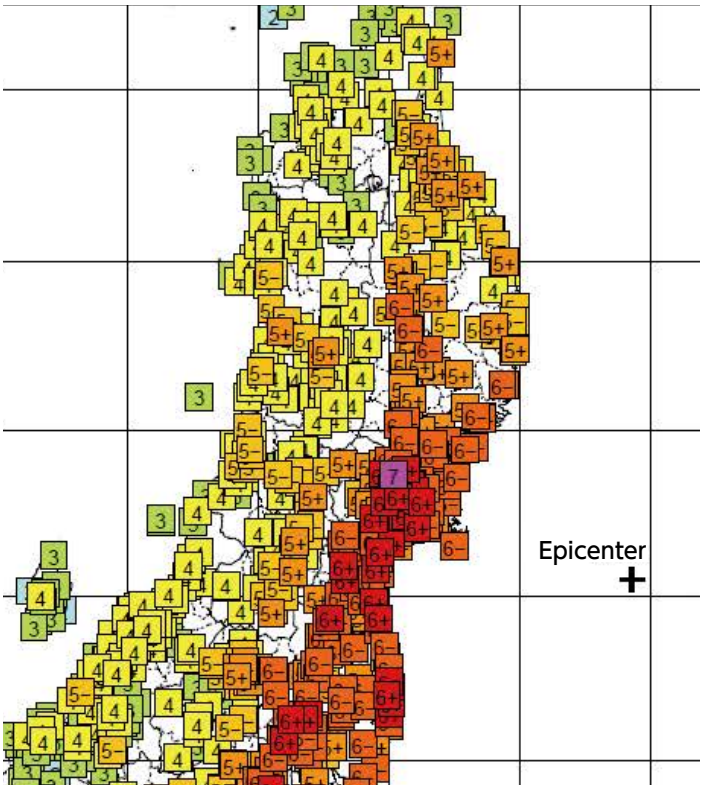
Children at Akamae Elementary School released about 100 salmon fry, which had been raised and cared for by elementary students in the aftermath of the tsunami disaster (on Apr. 28 at the Tsugaruishi River's riverbed).

1. Overview of Earthquake and Tsunami

(1) Overview of Earthquake

○ Date and time of earthquake occurrence: at 14:46 on Mar. 11, 2011
○ Name
On Mar. 11, the Japan Meteorological Agency named the earthquake as "the 2011 Earthquake Off the Pacific Coast of Tohoku." On Apr. 1, the Japanese Government officially announced the name of the disaster caused by the earthquake as "Higashi Nihon Daishinsai (The Great East Japan Earthquake)." Iwate Prefecture makes it a rule to use the name "Higashi Nihon Daishinsai Tsunami (The Great East Japan Earthquake and Tsunami)."
○ Epicenter: Off the coast of Sanriku, around 130 km ESE of the Oshika Peninsula
38° 6.21′ N, 142° 51.66′ E
○ Focal depth: about 24 km
○ Source region: estimated to be about 450 km in length and about 200 km in width
○ Magnitude: 9.0

With a magnitude of 9.0, the earthquake is the largest in Japan on record. The resulting massive tsunami waves struck north Japan region along the Pacific Coast in particular to cause a disaster of unprecedented scale, leaving about twenty thousand people dead or missing.
A seismic intensity of 7 was observed in Kurihara City, Miyagi, while ground motion with a seismic intensity of 6-upper or 6-lower was recorded over a wide range of the Pacific coast from Iwate to Ibaraki Prefectures (Fig. 1). A seismic intensity of 7 was observed for the third time in Japan following the Southern Hyogo Prefecture Earthquake (Great Hanshin-Awaji Earthquake) in 1995 and the Mid-Niigata Prefecture Earthquake in 2004.
In Iwate Prefecture, cities such as Ichinoseki and Ofunato recorded a seismic intensity of 6-lower, indicating that stronger ground motion was observed in the southern part of the prefecture for being closer to the hypocenter. In Miyako City, a seismic intensity of 5-upper was recorded in Moichi, and a seismic intensity of 5-lower in Kadoma Tashiro, Kuwagasaki, Satsuki-cho, Taro, Kawai, and Nagasawa (Fig. 2).
The main rupture duration time for this earthquake was about 160 seconds. There were aftershocks with a magnitude of 7.4 at 15:08 on the same day off the coast of Iwate Prefecture to the north of the source region and one with a magnitude of 7.6 (the largest aftershock) at 15:15 off the coast of Ibaraki Prefecture. Very active seismic activities continued thereafter as well (Fig. 3).
In terms of the mechanism, this was a typical subduction zone-type major earthquake caused by the bouncing back of the tip of the continental plate (the North American Plate) that had been dragged by the oceanic plate (the Pacific Plate) going down from the Japan Trench (Fig. 4).

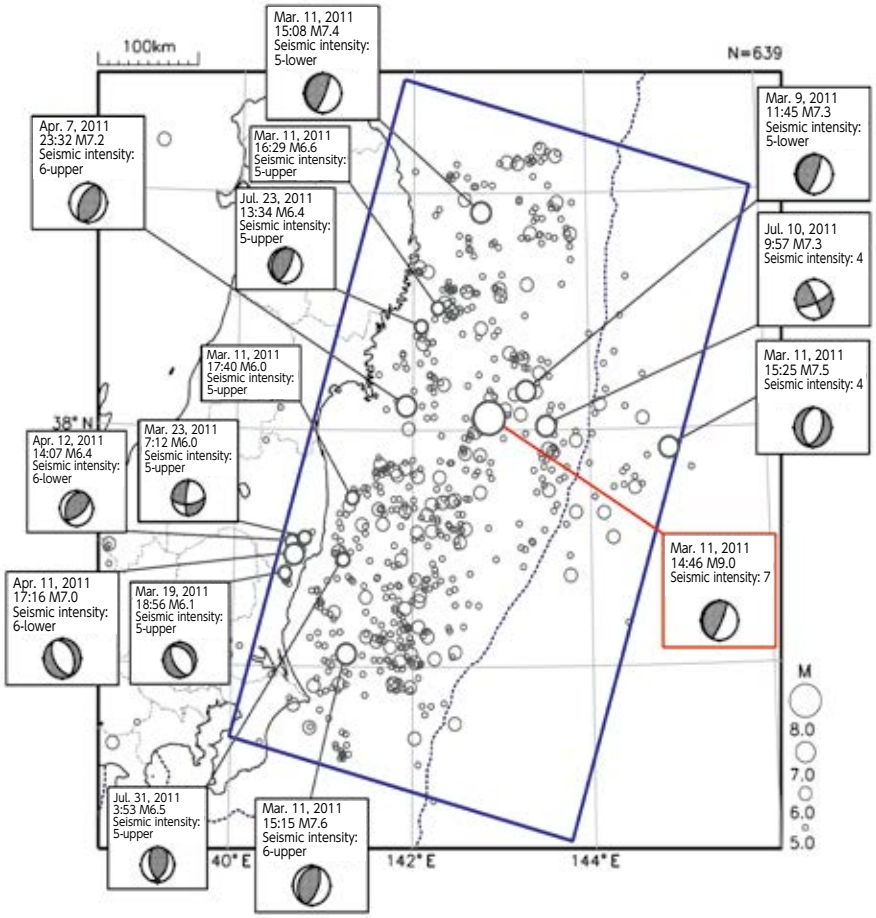


[Fig. 1] Distribution of Seismic Intensities of Municipalities for the Main Shock (with a Magnitude of 9.0 and a Maximum Seismic Intensity of 7), Which Occurred at 14:46 on Mar. 11
(Source: the Japan Meteorological Agency, Dec. 2012)

[Fig. 2] Seismic Intensities in Various Parts of Iwate Prefecture for Off the Pacific Coast of Tohoku Earthquake

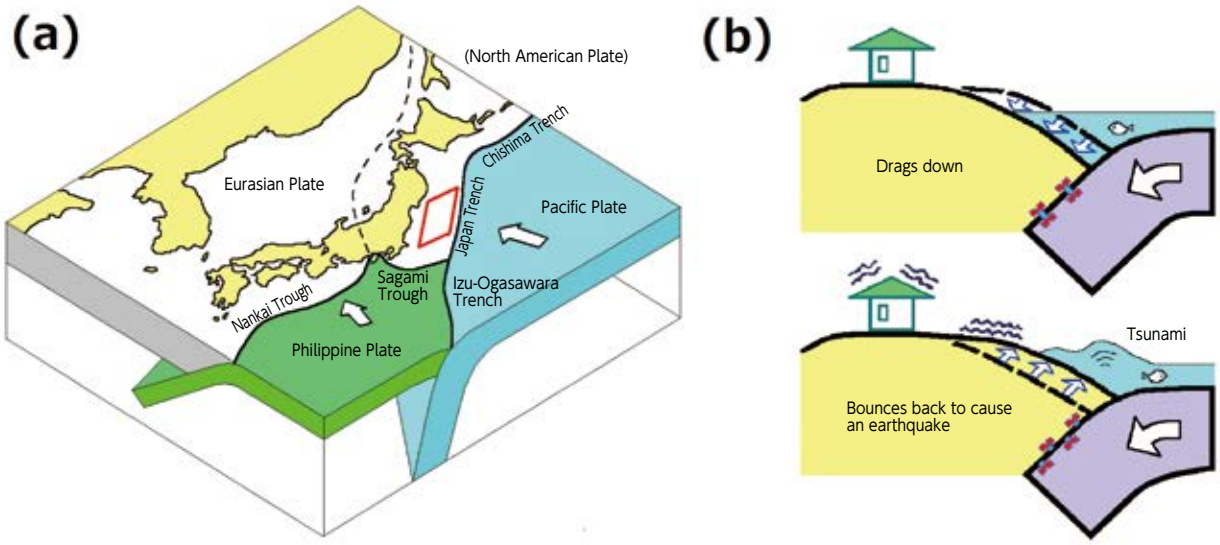
Seismic intensity of 6-lower	Nakazuma-cho, Kamaishi City(5.7); Minami-yahaba, Yahaba Town(5.7); Ofunato-cho, Ofunato City(5.6); Ikawa-cho, Ofunato City(5.6); Ukai, Takizawa Village(5.6); Hanaizumi-machi, Ichinoseki City(5.6); Fujisawa,, Fujisawa Town(5.6); O-hasama-machi, Hanamaki City(5.5); Murone-cho, Ichinoseki City(5.5); Maesawa-ku, Oshu City(5.5); Koromogawa-ku, Oshu City(5.5)
Seismic intensity of 5-upper	Tadakoe-cho, Kamaishi City(5.4); Yabukawa, Tamayama-ku, Morioka City(5.4); Yanagihara-cho, Kitakami City(5.4); Aisari-cho, Kitakami City(5.4); Esashi-ku, Oshu City(5.4); Doya, Fudai Village(5.3); Shibutami, Tamayama-ku, Morioka City(5.3); Towa-cho, Hanamaki City(5.3); Matsuzaki-cho, Tono City(5.3); Hiraizumi-cho, Hiraizumi Town(5.3); Dendo, Hachimantai City(5.2); Noda, Hachimantai City(5.2); Zaimoku-cho, Hanamaki City(5.2); Nishine, Kanegasaki Town(5.2); Sakurakawa, Mizusawa-ku, Oshu City(5.2); Osawa, Yamada Town(5.1); Setamai, Sumita Town(5.1); Sanno-cho, Morioka City(5.1); Higashiyama-cho, Ichinoseki City(5.1); Kawasaki-cho, Ichinoseki City(5.1); Ogane-cho, Mizusawa-ku, Oshu City(5.1); Moichi, Miyako City(5.0); Ishidoriya-cho, Hanamaki City(5.0); Miyamori-cho, Tono City(5.0); Daito-cho, Ichinoseki City(5.0)
Seismic intensity of 5-lower	Kadoma Tashiro, Miyako City(4.9); Noda, Noda Village(4.9); Sakari-cho, Ofunato City(4.9); Joboji-machi, Ninohe City(4.9); Hizume, Shiwa Town(4.9); Kuwagasaki, Miyako City(4.8); Satsuki-cho, Miyako City(4.8); Kozenji, Ichinohe Town(4.8); Obuke, Hachimantai City(4.8); Taro, Miyako City(4.7); Kawai, Miyako City(4.7); Hachiman-cho, Yamada Town(4.7); Baba-cho, Morioka City(4.7); Itsukaichi, Iwate Town(4.7); Kawasaki-cho, Kuji City(4.6); Osanai-cho, Kuji City(4.6); Ishikiridokoro, Niinohe City(4.6); Sengarita, Shizukuishi Town(4.6); Karumai, Karumai Town(4.6); Nagasawa, Miyako City(4.5); Fukuoka, Niinohe City(4.5); Kuzumaki Motoki, Kuzumaki Town(4.5); Ohasama General Branch Office, Hanamaki City(4.5)

Figures in parentheses indicate the recorded seismic intensity.
Prepared based on data published in *the Technical Report of the Japan Meteorological Agency,* No. 133. Dec. 2012



[Fig. 3] The Off the Pacific Coast of Tohoku Earthquake and Its Aftershocks
Each circle represents an earthquake with a magnitude of 5.0 or greater and a focal depth of 0-90 km that occurred from Mar. 1, 2011, to Feb. 29, 2012. In particular, boxes with lead lines refer to earthquakes with a magnitude or 7.0 or greater and those with a magnitude of 6.0 or greater and a seismic intensity of 5-upper or greater that occurred inside the tilted rectangular region. (Source: the Japan Meteorological Agency, Dec. 2012)

[Fig. 4] (a) Plate Structure around the Japan Islands
(b) Schematic Diagram of a Subduction Zone-Type Major Earthquake Caused by a Plate Going Down
(Source: Okada, Mar. 2012)



(Source: National Research Institute for Earth Science and Disaster Prevention. *Research Report on the 2011 Great East Japan Earthquake Disaster.*)

[Fig. 5] Assessments by the Earthquake Research Committee on Apr. 11, 2011

Assessments of the 2011 Off the Pacific Coast of Tohoku Earthquake

○ At about 14:46 on Mar. 11, an earthquake with a magnitude (M) of 9.0 (interim value) occurred off the coast of Sanriku with a focal depth of about 25 km. The scale of the main shock was the largest in Japan on record. For this earthquake, a maximum seismic intensity of 7 was observed in Kurihara City, Miyagi Prefecture. Furthermore, high tsunamis were observed along the Pacific coast of the Hokkaido, Tohoku, and Kanto regions, including a tsunami at least 7.3 m high in Soma, one at least 4.2 m high at Oarai, and one at least 4.1 m high in Kamaishi.

○ In terms of focal mechanism, the earthquake was caused by reverse-type faults with pressure axes in the WNW-ESE direction at the boundary between the Pacific oceanic plate and the continental plate.

○ As of 15:00 on Mar. 13, the largest aftershock so far is an earthquake of M 7.5 (interim value) that occurred at 15:08 on Mar. 11. Off the Pacific coast of Iwate to Ibaraki Prefectures, there have been three earthquakes of M 7.0 or greater and 40 aftershocks (interim value) of M 6.0 or greater. The source region for the aftershocks spans about 500 km in the north-south direction. Large-scale aftershocks may still arise in the future.

○ GPS observation revealed crustal deformations due to the main shock, including a displacement of Shizugawa observation station in Miyagi Prefecture in the ESE direction by about 4.4 m. Furthermore, along the coast of Iwate to Fukushima Prefectures, a maximum subsidence of about 75 cm has been observed with some areas continuing to be submerged even after the tsunami subsided.

○ The source region for this earthquake extends from off the coast of Iwate Prefecture to off the coast of Ibaraki Prefecture. According to diverse analysis results based on data such as seismic waves and crustal deformations, it is estimated that the earthquake had a source region of about 400 km long and about 200 km wide with a maximum slip amount of about 20 m or greater. The source region is considered to include off the coast of Miyagi Prefecture to the east of which the trench side of the southern part of off the coast of Sanriku, off the coast of Fukushima Prefecture, and off the coast of Ibaraki Prefecture, for which evaluations have been carried out by the Earthquake Research Committee. However, it may also have included the middle part of off the coast of Sanriku, the northern part of off the coast of Sanriku, and a part of the trench side of off the coast of Boso, Chiba Prefecture.

(Source: *Technical Report of the Japan Meteorological Agency,* No. 133. Dec. 2012)

(2) Overview of Tsunami

Since the Off the Pacific Coast of Tohoku Earthquake was a subduction zone-type massive earthquake with a magnitude of 9.0, its tsunamis also were of extraordinary scale. High tsunamis have been observed along the Pacific coast of Hokkaido to Okinawa with tsunamis having been also observed along the coast of the Sea of Japan, Sea of Okhotsk, and East China Sea. Furthermore, tsunamis have reportedly reached Hawaii as well as the Northern and Southern Americas.

At places such as Kamaishi and Ofunato in Iwate Prefecture and Ishinomaki in Miyagi Prefecture, the first wave of tsunami arrived at 14:46, or substantially at the same time as the occurrence of the earthquake, with a height of 10-20 cm, with the largest wave having hit at around 15:20, or about 30 minutes after the occurrence of the earthquake. In Miyako City, according to observation data at Hitachihama Beach tidal station of the Japan Meteorological Agency, the first tsunami was observed at 15:01 with another wave with a height of 8.5 m or more having been observed at 15:26 (These data may not be accurate since the tidal station was swept away. Fig. 6).

According to a report by the Earthquake Research Institute, the University of Tokyo, a tsunami run-up height of 37.9 m was observed at Koborinai, Taro. According to tsunami trace survey results by the 2011 Tohoku Earthquake and Tsunami Joint Survey Group, a maximum run-up height for the tsunami this time was 40.5 m at Omoe Aneyoshi, Miyako City. This figure broke the reputed highest run-up height in Japan on record of 38.2 m, which had been observed at the time of Meiji Sanriku Earthquake and Tsunami in 1896 at Ryori, Sanriku-cho, Ofunato City.

At 14:49, three minutes after the occurrence of the earthquake, the Japan Meteorological Agency issued major tsunami warnings for Iwate, Miyagi, and Fukushima prefectures, forecasting a tsunami height of 3 m. At 15:14, JMA updated the expected tsunami height to 6 m, and at 15:30 to over 10 m. However, some places near the coast were already hit by a tsunami at this time, or the updated information did not reach some other places because telecommunication there was cut off. Subsequently, JMA downgraded the alerts to tsunami warnings at 20:20 on Mar. 12, and then to tsunami advisories at 7:30 on Mar. 13, cancelling all warnings and advisories at 17:58 on Mar. 13 (Fig. 7).

The Sanriku Coast is known as zone frequented by tsunamis, suffering a number of massive tsunami disasters in the past, including the Meiji Sanriku Earthquake and Tsunami in 1896 (with a magnitude of 8.3), the Showa Sanriku Earthquake and Tsunami in 1933 (with a magnitude of 8.1), and the Chilean Earthquake and Tsunami in 1960. Furthermore, it has been reported that the Sendai Plain saw a tsunami run-up distance of about 3 km in the wake of the Jogan Earthquake in 869 during the Heian Era (with a magnitude of 8.3; Satake et al., 2008). It is said that the tsunami this time is similar to the Meiji Sanriku Tsunami in height and to the Jogan Earthquake in run-up distance inland from the coastline (Okada, 2012).

[Table. 6] Tsunami Observation Data Obtained at Tsunami Observation Facilities

Name of tsunami observation	First wave	Highest wave		Highest tidal level	
	Time of arrival (onset) a	Time of manifestation b	Height	Time of manifestation d	Tidal level measured by D.L.
	Day hour minute	Day hour minute	cm ＊9	Day hour minute	cm ＊9
Miyako ＊1 ＊4 ＊5	11 15 1	11 15 26	8.5 m or more	11 15 26	9.0 m or more
Ofunato ＊1 ＊3 ＊5 ＊6	11 14 —	11 15 18	8.0 m or more	11 15 18	9.8 m or more
Kamaishi ＊1 ＊5 ＊6	11 14 —	11 15 21	420 or more	11 15 21	642 or more
Off the coast of Kuji, Iwate ＊1 ＊2	11 14 —	11 15 19	4.0 m		
Off the coast of Miyako, Iwate ＊1 ＊2	11 14 —	11 15 12	6.3 m		
Off the coast of Kamaishi, Iwate ＊1 ＊2	11 14 48	11 15 11	6.7 m		

(Source: *Technical Report of the Japan Meteorological Agency,* No. 133. Dec. 2012)

* 1 There are periods for which data is not available.
* 2 The station has a GPS wave meter.
* 3 Observation has been made using a massive tsunami meter (with a measurement unit of 0.1 m).
* 4 The first wave was measured using a tidal gauge and the largest wave using a massive tsunami meter.
* 5 The reading of the first wave may not be accurate due to ground subsidence.
* 6 Fluctuations in tidal level caused by ground motion of the earthquake made it impossible to determine the time of the onset of the first wave from the tidal level data.
* 9 Data from massive tsunami meters and GPS wave meters are shown using a measurement unit of 0.1 m.

[Table. 7] Status of Tsunami Warnings and Advisories Issued
(Including Information on Expected Time of Arrival and Height for Tsunamis)

Region subject to tsunami forecast \ Issued time Top: warnings Bottom: expected heigh	11 14:49 14:50	11 15:14 15:14	11 15:30 15:31	11 16:08 16:09	11 18:47 18:47	11 21:35 21:36	11 22:53 22:53	12 3:20 3:20	12 13:50 —	12 20:20 —	13 07:30 —	13 17:58 —
Eastern Pacific coast, Hokkaido	0.5 m	1 m	3 m	6 m	→	→	→	→				Canceled
Middle Pacific coast, Hokkaido	1 m	2 m	6 m	8 m	→	→	→	→				Canceled
Western Pacific coast, Hokkaido	0.5 m	1 m	4 m	6 m	→	→	→	→				Canceled
Northern Japan Sea coast, Hokkaido						0.5 m	→	→		Canceled		
Southern Japan Sea coast, Hokkaido		0.5 m	1 m	→	→	→	→	→		Canceled		
Okhotsk Sea coast			0.5 m	→	→	→	→	→		Canceled		
Japan Sea coast, Aomori	0.5 m	1 m	2 m	3 m	→	→	→	→		Canceled		
Pacific coast, Aomori	1 m	3 m	8 m	10 m or more	→	→	→	→				Canceled
Mutsu Bay		0.5 m	1 m	→	→	→	→	→		Canceled		
Iwate Prefecture	3 m	6 m	10 m or more	→	→	→	→	→				Canceled
Miyagi Prefecture	6 m	10 m or more	→	→	→	→	→	→				Canceled
Akita Prefecture				0.5 m	→	→	→	→	Canceled			
Yamagata Prefecture				0.5 m	→	→	→	→	Canceled			
Fukushima Prefecture	3 m	6 m	10 m or more	→	→	→	→	→				Canceled
Ibaraki Prefecture	2 m	4 m	10 m or more	→	→	→	→	→				Canceled
Kujukuri/Boso, Chiba Prefecture	2 m	3 m	10 m or more	→	→	→	→	→				Canceled
Uchibo, Chiba Prefecture	0.5 m	1 m	2 m	4 m	→	→	→	→			Canceled	
Inner bay of Tokyo Bay		0.5 m	1 m	2 m	→	→	→	→			Canceled	
Izu Islands	1 m	2 m	4 m	6 m	→	→	→	→				Canceled
Ogasawara Islands	0.5 m	1 m	2 m	4 m	→	→	→	→				Canceled

*N/A means Not Available.
**Canceled means warnings/advisories were canceled.

[Fig. 8] Tsunami Survey Points and Tsunami Height

	Name of Observation point	Survey date	Survey time	Tsunami height (m)
99	Hitachihama-cho, Miyako City (near the Miyako tidal station) (i)	Mar. 28	12:00	7.3
100	Hitachihama-cho, Miyako City (near the Miyako tidal station) (ii)	Mar. 28	11:00	7.1
101	Hitachihama-cho, Miyako City (near the Miyako tidal station) (iii)	Mar. 28	12:25	5.1
102	Koganji, Miyako City	Mar. 28	13:45	8.5
103	Near the outfall of the Hei River, Fujiwara, Miyako City	Mar. 28	14:50	9.3

(Source: *Technical Report of the Japan Meteorological Agency,* No. 133. Dec. 2012)

* Hitachihama-cho, Miyako City (near the Miyako tidal station) (i) (ii) (iii); Koganji, Miyako City; and near the outfall of the Hei River, Fujiwara, Miyako City

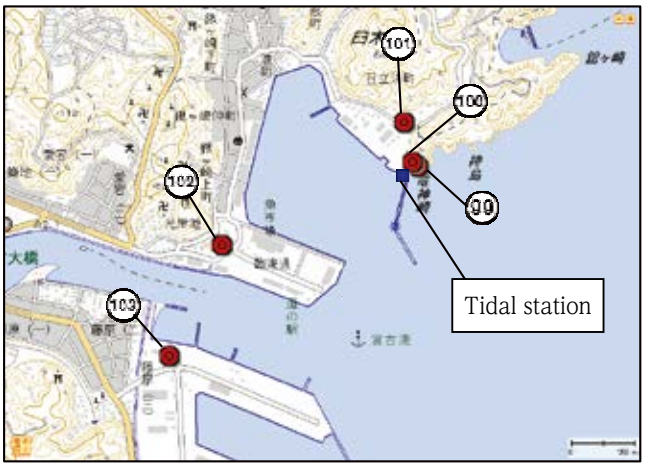


Fig. 3.2.83 Tsunami survey points

Photo 99 Traces of Tsunami (at point 99 in Fig. 3.2.83). Found drifts at places marked by red circles.

Photo 100 Traces of Tsunami (at point 100 in Fig. 3.2.83). Found drifts.

Photo 101 Traces of Tsunami (at point 101 in Fig. 3.2.83). Found drifts.

Photo 102 Traces of Tsunami (at point 102 in Fig. 3.2.83). Found drifts.

Photo 103 Traces of Tsunami (at point 103 in Fig. 3.2.83). Found drifts on trees.

2. Overview of Damage

(1) Inundation and Land Subsidence

Tsunamis caused by the 2011 Earthquake Off the Pacific Coast of Tohoku devastated Pacific coastal areas in eastern Japan. According to a report by the Geospatial Information Authority of Japan, the total inundated area for 64 municipalities in six prefectures (Aomori, Iwate, Miyagi, Fukushima, Ibaraki, and Chiba Prefecture) was 561 km^2. When classified by prefecture, Miyagi had a largest inundated area of 327 km^2, followed by Fukushima with 112 km^2. Iwate Prefecture stands at 58 km^2. With the Sendai Plain accounting for a significant part of land, Miyagi Prefecture had the largest inundated area by far. The coastal area of Iwate Prefecture was higher in inundation height but lower in inundated area as it is a Rias coast with little lowlands. In Miyako City, an area of 10 km^2 out of the total area of 1,260 km^2 was submerged (Fig. 10).

Ground subsidence and liquefaction also occurred in various places with liquefaction causing serious damage in eight prefectures (Iwate, Miyagi, Fukushima, Ibaraki, Gunma, Saitama, Chiba, and Kanagawa Prefecute) and Tokyo Metropolis. Analysis results of electronic reference points by the Geospatial Information Authority of Japan revealed significant ground subsidence in the Pacific coast of the Tohoku region (Fig. 11). Among Iwate, Miyagi, and Fukushima prefectures, the largest subsidence of -84 cm was observed in Otomo-cho, Rikuzentakata City. In Miyako City, the largest subsidence of -50 cm was observed in Fujiwara Pier, Sokei, followed by -44 cm in Motomachi, -42 cm in Chiwari 11, Tsugaruishi (Komagata-dori), and -33 cm in Chiwari 9, Tsugaruishi (Shin-machi). Because of the ground subsidence, flood including submersion of crops and fields occurs in coastal areas during high tides, when the tidal level changes greatly by the ebb and flow. As a result of this, civil work is in progress to raise the height of harbors.

(2) Casualties and Building Damage

In 12 prefectures, including Hokkaido and the Metropolis, the Great East Japan Earthquake and Tsunami left 15,859 people dead and 3,021 missing (according to a release by the National Police Agency on May 30, 2012; Fig. 12), causing serious damage only surpassed in the post-Meiji Era by the Great Kanto Earthquake (about 105,000 people dead or missing) in 1933 and the Meiji Sanriku Earthquake and Tsunami (about 22,000 people dead or missing) in 1896. In Iwate Prefecture, over 4,670 people died and over 1,140 people are missing (Fig. 12). In three prefectures of Iwate, Miyagi, and Fukushima, 92.4% of the victims were drowned (“White Paper on Disaster Management” for fiscal 2011).

According to a release from the General Disaster Management Office, General Affairs Department, Iwate Prefecture, the number of deaths including related deaths stands at 5,089 in the prefecture with 1,144 people missing, 209 people injured, and 25,023 houses destroyed (as of Sep. 30, 2013; Fig. 13). A survey from the Iwate prefectural government found 467 people dead, 94 people missing, 33 people injured, and 4,098 houses destroyed in Miyako City. According to a release by Miyako City (as of Nov. 6, 2012), when calculation was made it was based on the place of residence at the time of disaster, the number of deaths in the City stands at 517 with 94 people missing and 4,005 houses destroyed (houses that are more than partially destroyed).

(3) Overview of Damage in Miyako City

Let us look at the state of damage released by Miyako City (pp. 36-37). Classifying the 517 deaths by age group reveals that senior citizens aged 60 or more account for 64%, or about two out of three with 126 people (24.4%) being aged 70-79, 122 people (23.6%) aged 60-69, and 83 people (16.1%) aged 80-89. When the deaths are classified by place of residence, 181 people (35.0%) were from the Taro neighborhood, 68 people (13.2%) from the Miyako neighborhood, 65 people (12.6%) from the Sokei neighborhood, 57 people (11.0%) from the Kuwagasaki and Tsugaruishi neighborhoods respectively, and 48 people (9.3%) from the Omoe neighborhood.

Across the City, 9,088 houses sustained damage, which consisted of 4,449 dwellings and 4,639 non-dwelling houses. There were 2,677 dwellings that were completely destroyed, which represent 60.2% of the affected dwellings, illustrating the strength of this tsunami and the severity of damage. For reference, the number of houses (including non-dwelling houses) in the City as of the tsunami disaster was 39,907 according to the tax book.

The total amount of damage in Miyako City exceeds 245.6 billion yen (excluding damage to national/ prefectural government facilities, and that related to railroad, telecommunications, and electric operators). With the expenditure of general accounts of Miyako City being 29,606,417,000 yen for fiscal 2010, the amount of damage is more than eight years' worth of its annual total budget. Among the amount of damage, damage to housing represents the largest proportion with 149.6 billion yen, which accounts for about 60% of the total amount before mentioned. Damage to commercial- and labor-related facilities is 28.1 billion yen, fisheries-related damage 21.5 billion yen, damage to fishing harbors 15.0 billion yen, that to tourist facilities 13.6 billion yen. and that to public civil facilities such as rivers, roads, and bridges 7.7 billion yen.

[Table. 10] 2011 Earthquake Off the Pacific Coast of Tohoku: Inundated Area by Municipality

Prefecture	Municipality	Inundated area (㎢)	Municipal area (㎢)	Photographing date
Aomori		24	844	
Iwate		58	4,946	
	Miyako City	10	1,260	Mar. 13, Apr. 1, 5
	Ofunato City	8	323	Mar. 13, Apr. 1, 5
	Kuji City	4	623	Mar. 13, Apr. 5
	Rikuzentakata City	13	232	Mar. 13, Apr. 1
	Kamaishi City	7	441	Mar. 13, Apr. 1, 5
	Otsuchi Town	4	201	Mar. 13, Apr. 1
	Yamada Town	5	263	Mar. 13, Apr. 1, 5
	Iwaizumi Town	1	993	Mar. 13, Apr. 1, 5
	Tanohata Village	1	156	Apr. 5
	Fudai Village	1	70	Mar. 13, Apr. 5
	Noda Village	2	81	Mar. 13, Apr. 5
	Hirono Town	1	303	Mar. 13
Miyagi		327	2,003	
Fukushima		112	2,456	
Ibaraki		23	1,444	
Chiba		17	689	
Total		561	12,382	

* Inundated area is calculated by determining the occurrence of flooding to paddy fields and neighborhoods based on aerial photos ((Ei) standing for satellite image) and detecting inundated places by traces of debris (lakes, ponds and other inland waters are included in these figures).
** All areas of the Pacific coast (from Shimokita Hachinohe coast, Aomori Prefecture (south of Monomizaki) to Chiba Prefecture (Kujukurihama Coast)), which are considered to have sustained flooding damage, are subject to the survey.
*** Areas of municipalities are from "Nationwide Municipal Area Survey (as of Oct. 1, 2010; the Geospatial Information Authority of Japan)." (Source: The Geospatial Information Authority of Japan. "2011 Off the Pacific Coast of Tohoku Earthquake: Inundated Area by Municipality (Summary Figures) Fifth Report." Apr. 18, 2011.)

[Table. 11] List of Ground Subsidence Survey Results at Observation Stations in Iwate Prefecture

Name of municipality	Location	Amount of change (cm)	Station name	Station type
Miyako City	Motomachi	− 44	6884	Grade 1 benchmark
Miyako City	Chiwari 9, Tsugaruishi	− 33	6879	Grade 1 benchmark
Miyako City	Chiwari 4, Sokei	− 50	Fujiwara Pier	Grade 4 triangulation point
Miyako City	Chiwari 11, Tsugaruishi	− 42	Miyako	Electronic benchmark
Yamada Town, Shimohei District	Chiwari 16, Funakoshi	− 41	6870	Grade 1 benchmark
Yamada Town, Shimohei District	Chiwari 2, Funakoshi	− 43	6868	Grade 1 benchmark
Yamada Town, Shimohei District	Chiwari 10, Funakoshi	− 53	Uranohama	Grade 4 triangulation point
Yamada Town, Shimohei District	Orikasa	− 54	Yamada	Electronic benchmark
Otsuchi Town, Kamihei District	Chiwari 13, Kirikiri	− 35	6866	Grade 1 benchmark
Kamaishi City	Chiwari 3, Heita	− 56	6808	Grade 1 benchmark
Kamaishi City	Odaira-cho 3-chome	− 66	Kamaishi Daikannon	Grade 4 triangulation point
Kamaishi City	Kasshi-cho	− 56	Kamaishi	Electronic benchmark
Ofunato City	Aza Chinomori, Ofunato-cho	− 60	6789	Grade 1 benchmark
Ofunato City	Aza Tomioka, Ikawa-cho	− 73	Miyata	Grade 3 triangulation point
Ofunato City	Aza Nakamichishita, Sakari-cho	− 72	Sakari	Grade 4 triangulation point
Ofunato City	Aza Torisawa, Akasaki-cho	− 76	Ofunato	Electronic benchmark
Rikuzentakata City	Aza Takahata, Yonesaki-cho	− 58	6784	Grade 1 benchmark
Rikuzentakata City	Aza Nishinobo, Otomo-cho	− 84	Nishinobo	Grade 4 triangulation point
Rikuzentakata City	Aza Sugoroku, Kesen-cho	− 53	Sugoroku	Grade 4 triangulation point

Remarks: A benchmark has an accuracy of about 10 cm and an electronic benchmark an accuracy of about 1 cm.
(Source: The Geospatial Information Authority of Japan. *Ground Subsidence Survey for the 2011 Off the Pacific Coast of Tohoku Earthquake.* Apr. 14,2011.)

[Fig. 12] List of Casualties and Building Damage Nationwide

Type of damage / Prefecture		Casualties					Building damage									Road damage	Bridge damage	Landslide	Bank rips	Railroads
		Killed	Missing	Injured			Completely destroyed	Partially destroyed	Swept away	Completely destroyed by fire	Partially destroyed by fire	Inundated above floor level	Inundated below floor level	Partially damaged	Non-dwelling houses damaged					
				Seriously injured	Slightly injured	Total														
		People	People	People	People	People	Houses	Houses	Houses	Houses	Houses	Houses	Houses	Houses	Houses	places	places	places	places	places
Hokkaido		1			3	3		4				329	545	7	469					
Tohoku	Aomori	3	1	25	86	111	308	701						1,006	1,402	2				
	Iwate	4,673	1,144			212	18,460	6,563		33			6	14,191	5,401	30	4	6		
	Miyagi	9,537	1,297			4,148	82,896	155,095		135			7,796	222,824	28,745	390	12	51	45	26
	Akita			4	7	11								3	3	9				
	Yamagata	2		8	21	29								21	96	21		29		
	Fukushima	1,606	207	20	162	182	21,192	73,034		77	3	1,061	338	166,834	1,117	187	3	9		
Tokyo		7		20	97	117	15	198		1				4,847	1,101	295	55	6		
Kanto	Ibaraki	24	1	34	678	712	2,626	24,238		31		1,799	779	185,531	19,923	307	41			
	Tochigi	4		7	126	133	261	2,118						73,180	295	257		40		2
	Gunma	1		13	26	39		7						17,246		36		9		
	Saitama			7	38	45	24	199		1	1		1	1,800	33	160				
	Chiba	21	2	29	229	258	801	10,117		15		157	731	54,884	660	2,343		55		1
	Kanagawa	4		17	121	138		41						459	13	160	1	2		
	Niigata				3	3								17	9					
	Yamanashi				2	2								4						
	Nagano				1	1														
	Shizuoka			1	2	3							5	13	9					
Chubu	Gifu															1				
	Mie				1	1						2			9					
Shikoku	Tokushima											2	9							
	Kochi				1	1						2	8							
Total		15,883	2,652			6,149	126,583	272,315		297		3,352	10,218	742,867	59,285	4,198	116	207	45	29

* Prepared based on the Emergency Disaster Patrol Department, the National Police Agency, *State of the Damage from the 2011 Earthquake Off the Pacific Coast of Tohoku and Police Measures,* Oct. 10, 2013.
* Includes unconfirmed information.
* Includes damage by the earthquake that occurred on Apr. 7 with the hypocenter being off the coast of Miyagi Prefecture, the earthquake that occurred on Apr. 11 with the hypocenter being at Hamadori, Fukushima Prefecture, the earthquake that occurred on Apr. 12 with the hypocenter being at Nakadori, Fukushima Prefecture, the earthquake that occurred on May 22 with the hypocenter being at the northeastern part of Chiba Prefecture,the earthquake that occurred on Jul. 25 with the hypocenter being off the coast of Fukushima Prefecture, the earthquake that occurred on Jul. 31 with the hypocenter being off the coast of Fukushima Prefecture, the earthquake that occurred on Aug. 12 with the hypocenter being off the coast of Fukushima Prefecture, the earthquake that occurred on Aug. 19 with the hypocenter being off the coast of Fukushima Prefecture,the earthquake that occurred on Sep. 10 with the hypocenter being at the northern part of Ibaraki Prefecture, the earthquake that occurred on Oct. 10 with the hypocenter being off the coast of Fukushima Prefecture, the earthquake that occurred on Nov. 20 with the hypocenter being at the northern part of Ibaraki Prefecture, the earthquake that occurred on Feb. 19, 2012, with the hypocenter being at the northern part of Ibaraki Prefecture, the earthquake that occurred on Mar. 1 with the hypocenter being off the coast of Ibaraki Prefecture, the the earthquake that occurred on Mar. 14 with the hypocenter being off the eastern coast of Chiba Prefecture, the earthquake that occurred on Jun. 18 with the hypocenter being off the coast of Miyagi Prefecture, the earthquake that occurred on Aug. 30 with the hypocenter being off the coast of Miyagi Prefecture, the earthquake that occurred on Dec. 7 with the hypocenter being off the coast of Sanriku, and the earthquake that occurred on Jan. 31, 2013, with the hypocenter being at the northern part of Ibaraki Prefecture.

[Fig. 13] List of Casualties and Building Damage in Iwate Prefecture

	No. of people killed			No. of people missing		No. of people injured	No. of houses destroyed (dwellings more than partially destroyed)
	Directly-related deaths	Related deaths	Total		No. of deaths with certificate		
Rikuzentakata City	1,556	42	1,598	215	209	Unknown	3,341
Ofunato City	340	74	414	79	75	Unknown	3,934
Kamaishi City	888	98	986	152	151	Unknown	3,655
Otsuchi Town	803	50	853	433	429	Unknown	3,717
Yamada Town	604	67	671	149	147	Unknown	3,167
Miyako City	420	47	467	94	94	33	4,098
Iwaizumi Town	7	3	10	0	0	0	200
Tanohata Village	14	3	17	15	15	8	270
Fudai Village	0	0	0	1	1	4	0
Noda Village	38	1	39	0	0	19	479
Kuji City	2	1	3	2	2	10	278
Hirono Town	0	0	0	0	0	0	26
Coast subtotal	4,672	386	5,058	1,140	1,123	74	23,165
Inland subtotal	0	31	31	4	4	135	1,858
Total	4,672	417	5,089	1,144	1,127	209	25,023

Source: the General Disaster Management Office, General Affairs Department, Iwate Prefecture. *State of Damage for the Main Shock and Aftershocks on Mar. 11, 2011 and the Aftershock on Apr. 7*. As of Sep. 30, 2013.
* Among the number of deaths, directly related deaths were counted by the Iwate Prefectural Police and related deaths by the Iwate Regional Bureau of Reconstruction.
** For the number of houses destroyed, those completely destroyed and partially destroyed were counted.

A. Taro Area

Located in the northern part of the City, the Taro area is a fishery town facing the Pacific Ocean with urban areas centering on the Taro Fishing Harbor. Relatively small communities, such as the Settai and Koborinai neighborhoods, are widely scattered from the coastal area to the mountainous area. The key industry is fishing. Beach fishing of ear shells and sea urchins, as well as farming of wakame seaweed and konbu-tangles, is flourishing. Since efforts to increase salmon, which had disappeared due to polluted water from Taro Mine, brought back salmon to the Taro River, the River and the Tsugaruishi River have enjoyed the No. 1 position on Honshu Island in terms of salmon catch.

Taro is also known as “Tsunami Taro” for having sustained devastating damage from tsunamis in 1611, 1896, and 1933. Its history may be defined as a struggle with tsunamis. After the Showa Sanriku Earthquake and Tsunami, land readjustment in urban areas and the construction of dikes started. Completed in 1979, the huge dikes with a total length of 2,433 m were sometimes referred to as the “Great Walls of China in Taro.” Furthermore, people in Taro worked for disaster prevention from both the hardware and software points of view, establishing wireless communication for disaster prevention and tsunami evacuation routes and passing down tsunami experiences, eventually proclaiming to be a “Town of Tsunami Disaster Prevention” in 2003. Despite these efforts over the years as the “Town of Disaster Prevention,” the massive tsunami in 2011 flew over the first and third dikes and destroyed the second, recording a tsunami inundation height of 16.6 m in urban areas and a tsunami run-up height of 20.72 m.

Flowing over the dikes and destroying urban areas. the tsunamis caused inundation across the entire flat areas and swept away all buildings in areas of O-hira to the Osanai River. Over 1,300 people evacuated due to this devastating damage. Forest fires broke out in Aozari, Wano, Otobe, and near the Kumano Shrine in Ariya, which were finally extinguished in Mar. 16.

While Taro Daiichi Elementary School sustained no damage, the garage of Taro General Office facing the road was damaged. At Taro Daiichi Junior High School, the school building was inundated 30 cm above floor level with the schoolyard being completely filled with debris. Principal facilities, such as Taro Fish Market, Taro

Nursery, National Health Insurance Taro Clinic, and Miyako Fire Station Taro Branch Station, were completely destroyed. The first and second floor of the Taro Fishery Cooperative building was completely destroyed but was subsequently repaired and rehabilitated.
In the Settai neighborhood, the Ear Shell Breeding Center of the Settai Fishing Harbor was completely destroyed. On the Settai coast, the door of the floodgate was destroyed and carried upstream of the Settai River. Although the Shimosettai Bridge was swept away, Taro Daisan Elementary School was not inundated.

B. Miyako Area

Miyako City has been regarded as central city of the Rikuchu Coast in Iwate Prefecture. Urban and industrial infrastructure development has been carried out in the Miyako area, which serves as the center of the extended Miyako living sphere. Being close to the Sanriku fishing grounds and endowed with rocks of the rias coast and a sandy beach at the mouth of the Hei River, Miyako Bay boasts rich and diverse fish resources. Protected from the rough waves of the Pacific Ocean by Omoe Peninsula, the bay constitutes a fine harbor by nature. With a governor's office established already in the Edo period, Miyako Harbor in Nanbu became the most flourishing town of Morioka clan. Boasting the largest catch in Honshu Island of salmon known as "Nanbu crooked-nose salmon," the area is home to various marine products at all seasons, such as salmon, sauries, ear shells, sea urchins, and wakame seaweed. The area has continued to develop as a fishing and trading town after the Meiji Restoration. Subsequent to the Sanriku Earthquake and Tsunami in 1933, Miyako developed greatly with a copper refinery and lime manufacturing plant being established under the state policy and National Railway Yamada Line coming into service. When the Fujiwara Pier was built after the war, it became a harbor for sending in materials as companies in the lumber industry mainly engaged in plywood established bases in the hinterland of the harbor. With companies related to metal molds and connectors having been also invited, they now form key industries of the area along with the fishery and lumber.
The Miyako Area may be divided into central urban areas with an accumulation of commercial facilities centering on JR and Sanriku Railway Miyako Stations; the Atago, Tsukiji, and Koganji neighborhoods where offices of financial institutions and electric and communications operators line the streets; the Kuwagasaki neighborhood with a fish market, an accumulation of seafood processing facilities, and a scenic spot Jodogahama Beach; the Sakiyama neighborhood interspersed with scenic spots including Shiofukiana and Anegasaki and tourist facilities such as Nakanohama Camp; the Fujiwara neighborhood with harbor facilities and logistics facilities; the Sokei neighborhood dotted with Civic Culture Hall, Prefectural Miyako College of Miyako, a commercial high school, and a fisheries high school; the Takahama and Kanehama neighborhoods with residential areas and the Miyako-minami Interchange on the Sanriku Coast Road; the Tsugaruishi and Akamae neighborhoods with an accumulation of electronic component-related companies; and the Horinai and Shirahama neighborhoods being fishing village communities.

(i) Central urban areas

The tsunami this time engulfed the Desaki Pier and flew over the dike at Tsukiji and Shinkawa-cho, inundating up to the second floor of the City Hall and sweeping away six girders from the JR Yamada Line railroad bridge over the Hei River. The tsunami spread from Mukai-machi and Odori to Miyako Stations, Motomachi, Aramachi, Kurota-machi, and Suehiro-cho, leaving fishing boats aground in the Chuo-dori shopping street. Motomachi and Suehiro-cho shopping streets were also inundated to a height of 1.5 m with heaps of vehicles and debris left behind. Central urban areas sustained extensive damage.

(ii) Atago, Tsukiji, and Koganji neighborhoods

In the Tsukiji neighborhood where land was reclaimed after the Meiji Restoration and the Desaki Pier, which was completed in 1937, dwelling houses were swept away. Buildings such as those of Iwate Bank, NTT, and Tohoku Electric Power withstood the tsunami, but most of them had the first floor inundated. National Highway Route No. 45 was blocked by debris. In the Atago neighborhood, houses facing the Route were completely destroyed

with more than half of the buildings in the neighborhood being inundated.

(iii) Kuwagasaki neighborhood

As the Kuwagasaki neighborhood had no dike to stop tsunamis, flat areas were almost entirely devastated. The tsunamis that destroyed the fish market facing the quay of the fishing harbor and seafood processing-related facilities were met with the tsunamis that flew over the ridge of Tokonohama at Takonohama-cho. The Jodogahama Tourist Pleasure Boat that had been under maintenance in the dock landed in Minato-machi. At Kuwagasaki Elementary School, the schoolyard and the entrance to the school building were flooded with the gymnasium being inundated above floor level.

(iv) Sakiyama neighborhood

The floodgate at Onatsupe Beach was destroyed, causing more than half of the community to be inundated and the Miyako Farming Fishery Center to be completely destroyed. Also, Nakanohama Camp was swept away, the quay of the Yado Fishing Harbor was destroyed, and almost the entire Hideshima neighborhood was inundated.

(v) Fujiwara neighborhood

In the Fujiwara neighborhood, the floodgate before Nakaya Shipyard Company was destroyed. The tsunami crossed the dike at Fujiwara Pier to go inland, crossing National Highway Route No. 45 to reach JR Yamada Line railroads. In the vicinity of Route 45 and areas closer to the sea, seafood processing-related plants and houses, including the former Fujiwara Nursery, sustained major damage. At Fujiwara Elementary School, the schoolyard was inundated.

(vi) Sokei neighborhood

In the Sokei neighborhood, not only plywood plants and transportation/storage facilities at the pier that is closer to the sea than the dike, but also properties along National Highway Route 45, such as Northern Sanriku Forest Management Office and Miyako Civic Culture Hall, sustained severe damage. The tsunami crossed JR Sokei Station to inundate areas up to and including Sokei-nishi and Wamura areas. Along the Yagisawa River, areas up to and including plywood plants and Miyako Fisheries High School were also flooded. Furthermore, the Rias Harbor was completely destroyed and lumber (logs) carried away from the lumber stock.

(vii) Takahama and Kanehama neighborhoods

In Takahama and Kanehama, which had also suffered severe damage from the Chilean Earthquake Tsunami in 1960, National Highway Route 45 was blocked with debris, leaving the community isolated without vehicle access from the outside. In Takahama, the tsunami flew over the dike on which National Highway Route 45 ran to flood the area, causing major damage along the bus route with Takahama Community Center being completely destroyed. At Takahama Elementary School, the schoolyard was inundated. In the Kanehama neighborhood, the dike was damaged for a length of about 30 m, causing dwellings in flatland to be almost completely destroyed. Kozanji Temple was inundated. At Kanehama Shrine, the Shinto shrine archway was destroyed.

(viii) Tsugaruishi and Akamae neighborhoods

In Tsugaruishi, the tsunami passed the floodgate to go upstream of the Tsugaruishi River, submerging the Inari Bridge. In the Norinowaki neighborhood, almost all houses were swept away with a railroad train being derailed near Tsugaruishi Station. Tsugaruishi Branch Office and Tsugaruishi Public Hall were completely destroyed. In Motomachi, dwelling houses were completely destroyed or inundated to a height of 1.5 m above floor level. While Tsugaruishi Nursery was completely destroyed, damage to Tsugaruishi Elementary School was limited to the inundation of the schoolyard. The tsunamis that went upstream of the Tsugaruishi River entered the Neisawa River, also causing damage to the Shin-machi-shimo neighborhood.

In the Akamae neighborhood, the tsunami coming from the north engulfed the Sports Park, advancing straight to the south. Washing away dwellings in flatland, the tsunami brought a huge amount of debris to the schoolyard of Miyako Technical High School, inundating even the hatchery.

(ix) Horinai and Shirahama neighborhoods

The Kamagasawa neighborhood was inundated almost in its entirety. Furthermore, in the Koborinai, Horinai,

and Shirahama neighborhoods, more than half of the community was inundated. With the Omoe Peninsula Line coming to be submerged under seawater during high tide and the storm surge due to ground subsidence, construction work for raising the ground level is being carried out.

C. Omoe Area

Sticking out into the Pacific Ocean from the Sanriku Coast, the Omoe Peninsula is home to the rich fishing ground of Sanriku where the Japan Current meets the Kurile Current. For fish resources, such as wakame seaweed, tangles, sea urchins, ear shells, and salmon, the area boasts the highest catches along the Sanriku Coast both in terms of quality and quantity. Omoe also features rich natural environments of sea and mountains, including the Aneyoshi Camp Site, the gateway to the Todogasaki Lighthouse known as the eastern edge of Honshu Island that served as locale for the film *Yorokobi mo Kanashimi mo Ikutoshituki* (Times of Joy and Sorrow), Mt. Gassan commanding a whole view of the Miyako Bay, and Mt. Junishin with its primeval forest.

Most of the peninsula being mountains and forests, many people live in the hinterland of fishing harbors and nearby hills, such as Omoetate, Omoesato, Otobe, Aneyoshi, Chikei, and Ishihama. As is typical with rias coasts, the peninsula is lined with deep inlets and high cliffs. Starting from Akamae and running along the coast as the main local road of the area, the Omoe Peninsula Line includes many curves and uphill/downhill climbs to connect communities.

Because of facing the open sea, the area sustained severe damage in the Meiji and Showa Sanriku Earthquake Tsunamis. With almost all the population in Aneyoshi having been annihilated in the two tsunamis in the Meiji and Showa periods, people built a tsunami monument and relocated to a hill. Thus, although the tsunami this time recorded a maximum tsunami run-up height of 40.5 m in Aneyoshi, there were no houses swept away.

The tsunami hit all fishing harbors on the western side of the peninsula facing Miyako Bay, such as Shirahama, Uranosawa, and Oikiri, as well as those facing the open sea, such as Tatehama, Uiso, Aramaki, Omoe, Otobe, Aneyoshi, Chikei, Ishihama, and Kawashiro, to destroy dikes and seawalls. The pickup site, load handling site, refrigerators, seafood processing facilities, and seedling production facilities for salmon and ear shells were completely destroyed. Across the City, 2,629 fishing boats sustained damage.

At Otobesato and Omoesato, most dwelling houses were swept away. The Mukaiwatari Bridge in Omoesato broke down, leaving Aneyoshi, Chikei, and Ishihama isolated. At Chikei, the tsunami reached the Ueno Grocery along the prefectural road Omoe Peninsula Line with about half of the community in Ishihama also inundated. At Uiso Elementary School, the first floor of the school building was inundated, while Chikei Elementary School had up to the second floor of the school building inundated.

3. Status of Responses to the Great East Japan Earthquake and Tsunami

(1) Source: Records of the Great East Japan Earthquake: Miyako City, Iwate Prefecture. Status of Responses to the Great East Japan Earthquake (Final Report) as of Aug. 31, 2012

1. Status of Earthquake (According to a Release by the Japan Meteorological Agency)

(1) Time of occurrence: at about 14:46 on Mar. 11, 2011
(2) Epicenter: Off the coast of Sanriku (lat 38° 1′ N, long 142° 9′ E, about 130 km ESE of the Oshika Peninsula)
(3) Focal depth: about 24 km
(4) Magnitude at hypocenter: a magnitude of 9.0 (released on Mar. 13, 2011, by the Japan Meteorological Agency)
(5) Seismic intensity: 5-upper in Moichi
5-lower in Satsuki-cho, Kuwagasaki, Nagasawa, Taro, Kawai, and Kadoma-Tashiro
(6) Issuance of warnings and advisories: at 14:49 on Mar. 11, 2011, Major tsunami warning for Iwate Prefecture
At 20:20 on Mar. 12, 2011, Downgraded to tsunami warning
At 7:30 on Mar. 13, 2011, Downgraded to tsunami advisory
At 17:58 on Mar. 13, 2011, Tsunami advisory canceled

2. Status of Tsunami (According to a Release by the Japan Meteorological Agency)

(1) Largest wave at 15:26 on Mar. 11, 2011; over 8.5 m in height (*1)
Tsunami height estimated based on traces etc.: 7.3 m (*2)
*1 According to analysis of records at tsunami observation points recovered on-site at a later date.
*2 Survey results of tsunami height based on tsunami traces etc. at tsunami observation points (released on Apr. 5, 2011, by Morioka Meteorological Office)
(For reference) Tsunami run-up height (the height of land up to which the tsunami reached)
○ Taro Koborinai neighborhood: 37.9 m (according to a release by Earthquake Research Institute, University of Tokyo)
○ Omoe Aneyoshi neighborhood: 40.5 m (according to a release by The 2011 Tohoku Earthquake Tsunami Joint Surbey (TTJS)Group)

3. Establishment and Removal of Miyako City Headquarters for Disaster Countermeasures

(1) Establishment of Miyako City Headquarters for Disaster Countermeasures: at 14:46 on Mar. 11, 2011
(2) Removal of Miyako City Headquarters for Disaster Countermeasures: at 17:00 on Aug. 31, 2012
* So far, Miyako City Headquarters for Disaster Countermeasures Meeting (joint meeting with related authorities) has been held for 78 times to coordinate activities.

4. Closing of Floodgates and Sluice Gates

(1) At the time of the issuance of warning, 111 floodgates and sluice gates were closed (93 gates in the Miyako neighborhood, 18 gates in the Taro neighborhood)
* There were 25 places that sustained damage, including 11 places in the Miyako neighborhood and 14 places in the Taro neighborhood.

5. Status of Evacuation

(1) Issuance of evacuation order: at 14:49 on Mar. 11, 2011
(2) Cancellation of evacuation order: at 17:58 on Mar. 13, 2011
(3) People subject to evacuation order: 5,277 households, 12,842 people
(4) No. of evacuees: up to 8,889 individuals at 85 places (All designated shelters were closed on Aug. 10, 2011)
(5) Responses to evacuees
Provision of food, distribution of boiled rice (at some shelters), provision of water, provision of blankets, provision of daily necessities, installation of temporary latrines (at some shelters), assistance for bathing (at some shelters), provision of medical treatment (medical teams from Miyako Medical Association), Installation of satellite phones (at some shelters), etc.

6. State of Damage

(1) Casualties and damage to dwellings etc. (as of Aug. 3, 2012)

Casualties				Damage to dwellings etc.				
Deaths with certificate	Declared deaths in absentia	Total	People missing	Completely destroyed	Severely destroyed	Partially destroyed	Partially damaged	Total
407	110	517	96	5,968	1,335	1,174	611	9,088

* The declared deaths in absentia overlap the people missing. The difference (14 people) between the number of declared deaths in absentia (110 people) and that of the people missing (96 people) stands for the number of people who have been identified after the submission of a death declaration by way of the remains or DNA typing.

7. Status of Restoration of Lifelines

(1) Power (according to a release by Tohoku Electric Power)
- Mar. 14: Restored in the Iwate Prefectural Miyako Hospital and Iwate Prefectural Regional Development Bureau
- Mar. 21: Among 16,000 cases of power outage, about 4,000 have been swept away. Restoration work continued for about 12,000 cases.
- Mar. 25: Power restored to the City Hall (generators had been used in the interim); power restored to 40% of the City (house-to-house restoration)
- Apr. 15: The Tohoku Electric Power branch office received power.
- Apr. 30: Restoration completed for the City.

(2) Waterworks
- Mar. 14: A restoration rate of 60%
- Mar. 18: A restoration rate of 76%
- Mar. 24: A restoration rate of 90%
- Apr. 15: A restoration rate of 100%

(3) Communications
○ Fixed telephones
- Mar. 30: Restored in the Miyako Telephone Office
- Mar. 31: Optical cables restored in the City Hall.
- Apr. 15: Restored across the City (Restored in all neighborhoods of the City)

○ Mobile phones
- Mar. 21: NTT docomo service partially restored (Service restored in areas excluding the Omoe and Taro neighborhoods.)
- Apr. 15: NTT docomo and au service completely restored; SoftBank service temporarily restored (available for use with au, NTT docomo (excluding the periphery of Omoesato, Todogasaki, and Nakanohama)), and SoftBank

○ Specially installed pay phones
- Mar. 14: NTT's pay phones, satellite phones etc. were installed at shelters.
- Mar. 22: Emergency disaster broadcasting by Miyako Emergency FM 77.4 MHz
(4) Public transport
○ JR Yamada Line
- Mar. 26: Normal service resumed between Miyako and Morioka; replacement buses are operated between Miyako and Iwate Funakoshi and at the Iwaizumi Line.
(Railroad tracks have been swept away from the Hei River Railroad Bridge,which broke down, to Tsugaruishi. Restoration methods are being considered.)
○ Sanriku Railway
- Mar. 20: A shuttle service between Miyako and Omoto started with three round trips per day.
- Mar. 29: In operation with four round trips per day.
○ Kenpoku Bus
- Mar. 16: Bus Line 106 resumed service.
- Mar. 18: Service resumed in all lines.
(5) Roads
- For national highway routes, road-clearing work started on major trunk roads on the date of the disaster. Police started to regulate traffic.
- In coordination with national highway routes and prefectural roads, road-clearing work started at major municipal roads in order.
- Mar. 14: National Highway Routes come into service.
- Mar. 16: The prefectural road Omoe Peninsula Line come into service.
- Mar. 23: Removal of wrecked left on public road completed. (1,300 cars)
- Mar. 29: Road clearing work mostly completed.
- Apr. 15: Removal of debris left on sidewalks completed. Moving to the main restoration work from now on.
- Jul. 31: Blockage at the Tateai railroad crossing on the JR Yamada Line was canceled.

8. Other

(1) Quick-fix temporary houses (Houses for initial applicants have been occupied by Aug. 11, 2011)

No. of houses built		Status of occupation (Having been occupied by Jul. 6, 2012)		
No. of places	No. of houses	No. of places occupied	No. of houses	No. of residents
62	2,010	60	1,713	3,883

(2) Principal systems that have been applied
- Designation as serious disaster (decided upon by the Cabinet on Mar. 12, 2011)
- Application of the Disaster Relief Act (decided by the governor of Iwate Prefecture on Mar. 12, 2011)
- Application of the Act Concerning Support for Reconstructing Livelihoods of Disaster Victims (decided by the governor of Iwate Prefecture on Mar. 12, 2011)

4. Number of People Killed and Missing by the Great East Japan Earthquake and Tsunami

As of Nov. 6, 2012

■ Age Group (The number of declared deaths in absentia under the people killed column overlaps that under the people missing column.)

Age group	People killed			People missing
	Deaths with certificate	Declared deaths in absentia	Total	*Declared deaths in absentia
0-9	10	9	19	9
10-19	2		2	
20-29	10	5	15	5
30-39	16	11	27	8
40-49	28	11	39	10
50-59	56	14	70	11
60-69	91	31	122	25
70-79	106	20	126	19
80-89	74	9	83	7
90-99	14		14	
Total	407	110	517	94

■ Sex (The number of declared deaths in absentia under the people killed column overlaps that under the people missing column.)

Sex	People killed			People missing
	Deaths with certificate	Declared deaths in absentia	Total	*Declared deaths in absentia
Male	182	69	251	59
Female	225	41	266	35
Total	407	110	517	94

■ Address (The number of declared deaths in absentia under the people killed column overlaps that under the people missing column.)

Neighborhood	People killed			People missing
	Deaths with certificate	Declared deaths in absentia	Total	*Declared deaths in absentia
Miyako	63	5	68	5
Kuwagasaki	48	9	57	8
Sentoku	11	1	12	1
Sokei	58	7	65	7
Sakiyama	8	14	22	9
Hanawa	5	1	6	
Tsugaruishi	53	4	57	3
Omoe	24	24	48	20
Taro	136	45	181	41
Niisato	1		1	
Total	407	110	517	94

□ "Deaths with certificate" refer to people who had resident registration with Miyako City as of Mar. 11, 2011, and who died of a cause directly related to the Great East Japan Earthquake and Tsunami (the cause of death being drowning, pneumonia etc.)

□ The difference (16 people) between the number of declared deaths in absentia under the People killed column (110 people) and that under the People missing column (94 people) stands for the number of people who have been identified after the submission of a death declaration by way of the remains or DNA typing.

Neighborhood		People killed			People missing
		Deaths with certificate	Declared deaths in absentia	Total	*Declared deaths in absentia
Miyako	Shinkawa-cho	7		7	
	Mukai-machi	24	1	25	1
	Odori	2		2	
	Tateai-cho	1		1	
	Nishi-machi	1		1	
	Yamaguchi	5		5	
	Hokuda		1	1	1
	Kurota-machi	2		2	
	Tsukiji	9	2	11	2
	Atago	1		1	
	Koganji	11		11	
	Miyazono		1	1	1
		63	5	68	5
Kuwagasaki	Kuwagasaki	17	3	20	3
	Nakasato-danchi	1		1	
	Hikage-cho	1		1	
	Kumano-cho	3	2	5	2
	Takonohama-cho	17	1	18	1
	Yamane-cho	5	1	6	1
	Minato-machi	1		1	
	Hitachihama-cho	3	1	4	1
	Hinode-cho		1	1	
		48	9	57	8
Sentoku	Chikanai	3		3	
	Nishigaoka	1		1	
	Nagane	4	1	5	1
	Ota	1		1	
	Kanpana	1		1	
	Itaya	1		1	
		11	1	12	1

Neighborhood		People killed			People missing
		Deaths with certificate	Declared deaths in absentia	Total	*Declared deaths in absentia
Sokei	Fujiwara	5	1	6	1
	Koyamada	3	1	4	1
	Sokei	8		8	
	Wamura	1	1	2	1
	Kanan	1		1	
	Kanbayashi	3	1	4	1
	Fujinokawa	2		2	
	Yagisawa	4	1	5	1
	Takahama	4	1	5	1
	Kanehama	27	1	28	1
		58	7	65	7
Sakiyama	Sakiyama	3	1	4	
	Sakikuwagasaki	5	13	18	9
		8	14	22	9
Hanawa	Takusari	1		1	
	Matsuyama	1		1	
	Roki		1	1	
	Nagasawa	3		3	
		5	1	6	
Tsugaruishi	Tsugaruishi	28	3	31	2
	Akamae	25	1	26	1
		53	4	57	3
Omoe	Omoe	21	23	44	19
	Otobe	3	1	4	1
		24	24	48	20
Taro	Taro	136	45	181	41
		136	45	181	41
Niisato	Kariya	1		1	
		1		1	
Total		407	110	517	94

5. Number of Houses Destroyed by the Great East Japan Earthquake and Tsunami

■ Breakdown of the Number of Destroyed Houses (as of Jun. 29, 2012) Unit: houses

Neighborhood	Dwellings					Non-dwelling houses				
	Completely destroyed	Severely destroyed	Partially destroyed	Partially damaged	Total	Completely destroyed	Severely destroyed	Partially destroyed	Partially damaged	Total
Miyako	461	242	208	170	1,081	447	233	168	71	919
Kuwagasaki	527	16	16	36	595	487	11	9	10	517
Fujiwara	82	129	85	27	323	123	114	59	9	305
Sokei	133	109	146	80	468	185	81	118	18	402
Takahama	66	34	29	11	140	99	41	29	9	178
Kanehama	129	5	1	5	140	159	5	2	1	167
Shirahama	15	2	4	4	25	43	2	5	0	50
Sakiyama	40	4	10	27	81	90	4	1	7	102
Hanawa	0	0	1	10	11	0	0	3	7	10
Tsugaruishi	414	116	104	49	683	538	124	88	20	770
Omoe	81	4	3	8	96	295	11	6	6	318
Taro	729	27	32	13	801	821	21	45	3	890
Niisato	0	0	1	2	3	3	0	1	5	9
Kawai	0	0	0	2	2	1	0	0	1	2
Total	2,677	688	640	444	4,449	3,291	647	534	167	4,639

Neighborhood	Total				
	Completely destroyed	Severely destroyed	Partially destroyed	Partially damaged	Total
Miyako	908	475	376	241	2,000
Kuwagasaki	1,014	27	25	46	1,112
Fujiwara	205	243	144	36	628
Sokei	318	190	264	98	870
Takahama	165	75	58	20	318
Kanehama	288	10	3	6	307
Shirahama	58	4	9	4	75
Sakiyama	130	8	11	34	183
Hanawa	0	0	4	17	21
Tsugaruishi	952	240	192	69	1,453
Omoe	376	15	9	14	414
Taro	1,550	48	77	16	1,691
Niisato	3	0	2	7	12
Kawai	1	0	0	3	4
Total	5,968	1,335	1,174	611	9,088

■ Breakdown of the Number of Destroyed Houses (Preliminary Data as of the Early Phase After the Occurrence of Disaster)

Neighborhood	Completely destroyed	Severely destroyed	Partially destroyed	Inundated above floor level	Inundated below floor level	Total
Miyako	722	647	118	1,262	247	2,996
Kuwagasaki	646	136		33		815
Sakiyama	148	24		17	6	195
Hanawa						0
Tsugaruishi	426	136	57	287	56	962
Omoe	118	4	1	11	2	136
Taro	1,609	59		150	12	1,830
Total	3,669	1,006	176	1,760	323	6,934

* The figures as of Jun. 29, 2012, have been calculated from resident card information at the time of the earthquake disaster and counting the number of applications for disaster sufferer certificate. Buildings for which redundant counting is suspected have been checked using house maps.

■ Amount of housing damage

Completely destroyed	Severely destroyed	Partially destroyed	Partially damaged
123,537,600,000 yen	13,817,250,000 yen	9,720,720,000 yen	2,529,540,000 yen
Total: 149,605,110,000 yen			

6. Total Estimated Amount of Damage by the Great East Japan Earthquake and Tsunami

245,660,884,000 yen

Damage category	Estimated amount of damage (in thousand yen)	Survey rate (%)	Remarks
Government buildings	470,178	100	Damage to government buildings, structures, fixtures etc.
Communications facilities	9,366	100	Damage to community television reception facilities
Social welfare facilities	1,745,167	100	Damage to buildings and facilities
Social education facilities	523,705	100	Damage to buildings and facilities
Cultural facilities	1,115,000	100	Damage to buildings and facilities
Athletic facilities	655,467	100	Damage to buildings and facilities
Waterworks facilities	341,000	100	Damage to waterworks and small water supply facilities
Medical/Health facilities	1,692,365	100	Damage to hospitals, Health Center etc.
Firefighting and disaster prevention facilities	780,536	100	Damage to government buildings, machinery, facilities etc.
Tourist facilities	13,600,504	100	Damage to public facilities and guesthouse facilities
Commerce-, industry- and labor-related facilities	28,107,000	100	Commerce-related and industry-related damage
Fisheries-related	21,506,426	100	Damage to fisheries facilities, fishing boats, fishing implements, farming facilities, and aquatic products
Fishing harbor facilities	15,033,087	100	Damage to fishing harbor facilities, coastal facilities, fishing ground facilities, and fishing village facilities
Agricultural facilities	36,080	100	Damage to agricultural facilities
Livestock-related	621	100	Damage to livestock products
Farmland and agricultural facilities	1,629,325	100	Damage to farmland, agricultural facilities, and coastal protection facilities
Forestry-related	426,920	100	Damage to forestry facilities, forest products, and forests
Public works facilities	7,738,258	100	Damage to rivers, roads, bridges, parks, and sewer
Public housing etc.	422,393	100	Damage to public housing
Schools	210,292	100	Damage to buildings, structures, land, facilities etc.
Cultural properties	12,084	100	Damage to cultural properties
Housing	149,605,110	100	The estimation method by Development Bank of Japan, Inc. in “Damage to Housing Capital Stock” has been applied with necessary modifications.

Breakdown of Estimated Amount of Damage by the Great East Japan Earthquake by Damage Category

Damage category	Breakdown (Estimated amount of damage/Name of facilities etc./State of damage)
Government buildings etc. 470,178,000 yen	[Main government buildings etc.] (266,633,000 yen/Main government buildings: 2 places, branch government buildings/Inundated above floor level) [Odori Hall] (26,887,000 yen/Partially destroyed) [Damage to equipment] (167,658,000 yen/First floor of the main government building, official vehicles: 71 cars, a set of computers) [Garage of the Taro General Office] (3,000,000 yen/Partially damaged) [Nakamachi bus waiting room] (6,000,000 yen/Completely destroyed)
Communications facilities 9,366,000 yen	[Community television reception facilities] (9,366,000 yen/Nakanohama, Hitachihama, Sokei, Tsugaruishi, Shirahama, Kawashiro)
Social welfare facilities 1,745,167,000 yen	[Municipal Nursery] (85,161,000 yen/Tsugaruishi, Taro, Chikei/Completely destroyed, Niisato/Equipment damaged) [Municipal Children's Hall] (3,842,000 yen/Takahama/Inundated above floor level, Taro/Land damaged) [Private nurseries] (10,346,000 yen/Miyako Nursery/Partially destroyed, Sokei Nursery/Inundated above floor level) [Children's parks] (3 places) [Children's pleasure garden] (1 place) [Elderly welfare center etc.] (95,213,000 yen/Sokei Elderly Welfare Center, nursing care prevention base facilities in the Ishihama neighborhood/Completely destroyed) [Thalassotherapy facilities] (1,403,000,000 yen/Partially destroyed) [Taro Senior Citizen Community Center] (245,000 yen/Inundated above floor level) [Private daycare facilities etc.] (147,360,000 yen/10 places/Completely destroyed etc.)
Social education facilities 523,705,000 yen	[Self-Governing Bodies' Training Center] (110,400,000 yen/Taro, Otobe neighborhood/Completely destroyed) [Public Hall] (319,105,000 yen/Tsugaruishi, Kuwagasaki/Completely destroyed, Sokei, Taro/Partially damaged) [Community Center] (94,200,000 yen/Takahama, Horinai/Completely destroyed, Uiso/Partially destroyed)
Cultural facilities 1,115,000,000 yen	[Civic Culture Hall] (1,115,000,000 yen/Partially destroyed, structures damaged)
Athletic facilities 655,467,000 yen	[Fujinokawa Beach] (23,000,000 yen/lavatories etc. completely destroyed) [Taro Ball Park] (562,079,000 yen/Completely destroyed) [Taro Gate Ball Court] (20,000,000 yen/Inflow of sediment) [Sentoku Gymnasium] (388,000 yen/Underground drainpipes ruptured) [Landing stage at the Rias Harbor Miyako] (50,000,000 yen/Structures swept away)
Waterworks facilities 341,000,000 yen	[Waterworks facilities] (223,000,000 yen/8 sites/equipment etc. damaged) [Small water supply facilities] (118,000,000 yen/3 sites/equipment etc. damaged)
Medical/Health facilities 1,692,365,000 yen	[Miyako Health Center] (400,000,000 yen/Partially destroyed) [Clinics] (600,000,000 yen/Holiday emergency clinics/Partially destroyed, National Health Insurance Taro Clinic/Completely destroyed) [Private hospitals etc.] (687,365,000 yen/26 facilities/Completely destroyed etc.) [Pollution laboratory] (1,000,000 yen/Inundated above floor level) [Kurota-machi public latrines] (4,000,000 yen/Partially destroyed)
Firefighting and disaster prevention facilities 780,536,000 yen	[Emergency administrative radio system support stations] (142,500,000 yen/57 places/Swept away etc.) [Emergency administrative radio system receiver for each house] (92,350,000 yen/1,847 units/Swept away etc.) [Emergency administrative radio system mobile transceivers] (26,680,000 yen/46 units/Swept away etc.) [Tide level observation device] (17,000,000 yen/3 places/Completely destroyed) [Evacuation guidance signs etc.] (24,800,000 yen/60 places/Completely destroyed) [Handrails on evacuation routes] (2,000,000 yen/5 places 100 m/Damaged) [Fire stations etc.] (348,605,000 yen/7th, 16th, 24th, 26th, 29th, 30th branches/Completely destroyed, 1st, 2nd, 6th, 11th, 28th branches/Partially destroyed, 4th, 5th, 8th, 10th, 20th, 25th branches/Inundated above floor level) [Fire engines etc.] (126,262,000 yen/15 cars/Swept away etc.) [Fire hydrants] (157,000 yen/2 places) [Water tanks for fire prevention] (182,000 yen/1 place)
Tourist facilities 13,600,504,000 yen	[Natural parks] (10,168,000,000 yen/Park facilities: 10 places, Camp: 2 places, Jodogahama Rest House, Shower facilities etc.: 3 places) [Tourist facilities] (3,432,504,000 yen/Seatopia Naado, Shiosato Station, Beef Village Kuzakai, guesthouses etc.: 33 places)
Commerce-, industry- and labor-related facilities 28,107,000,000 yen	[Disaster-affected places of business] (28,003,000,000 yen/Commercial and industrial places of business: 1,154 places) [Miyako Bay Workers' Welfare Center] (104,000,000 yen/Completely destroyed)
Fisheries-related 21,506,426,000 yen	[Fisheries facilities] (11,056,227,000 yen/643 places) [Fishing boats] (4,454,536,000 yen/2,629 boats) [Fishing implements] (1,871,561,000 yen/33 places) [Farming facilities] (1,701,994,000 yen/2,973 places) [Aquatic products] (2,422,108,000 yen/14,252 ton)

Breakdown of Estimated Amount of Damage by the Great East Japan Earthquake and Tsunami by Damage Category

Damage category	Breakdown (Estimated amount of damage/Name of facilities etc./State of damage)
Fishing harbor facilities 15,033,087,000 yen	[Enclosure facilities] (7,980,569,000 yen/46 places) [Mooring facilities] (624,449,000 yen/26 places) [Water area facilities] (356,129,000 yen/13 places) [Transportation facilities] (504,057,000 yen/19 places) [Fishing harbor facilities site] (236,650,000 yen/17 places) [Dikes] (3,419,550,000 yen/5 places) [Fishing community facilities etc.] (294,539,000 yen/7 places) [Fishing ground facilities] (1,617,144,000 yen/2 places)
Agricultural facilities 36,080,000 yen	[Agricultural and fishing village center] (36,080,000 yen/Kanehama, Chikei/Completely destroyed)
Livestock-related 621,000 yen	[Livestock products] (621,000 yen/Raw milk 6,150 kg)
Farmland and agricultural facilities 1,629,325,000 yen	[Paddy fields] (836,133,000 yen/60 ha) [Fields] (66,993,000 yen/15 ha) [Irrigation and drainage canals] (55,939,000 yen/120 places) [Pumps] (18,000,000 yen/6 places) [Farm roads] (39,260,000 yen/120 places) [Coastal protection facilities] (613,000,000 yen/1 place)
Forestry-related 426,920,000 yen	[Forestry conservancy facilities] (16,800,000 yen/4 places) [Tide-water control forests] (217,184,000 yen/2 places) [Forest roads] (105,600,000 yen/59 places) [Mushroom logs] (8,920,000 yen/49,100 pieces) [Mushroom cultivation facilities] (10,800,000 yen/3 places) [Special forest products] (3,066,000 yen/77 kg) [Dryers] (7,800,000 yen/13 units) [Other machinery] (13,600,000 yen) [Forest fire] (23,602,000 yen/37.47 ha) [Washout of forest] (15,540,000 yen/7.04 ha) [Salt damage to forests] (4,008,000 yen/1.37 ha)
Public works facilities 7,738,258,000 yen	[Roads] (4,229,330,000 yen/43 places) [Bridges] (24,182,000 yen/13 places) [Rivers] (270,690,000 yen/22 places) [Sewer facilities] (555,791,000 yen/6 places) [Drainage facilities for fishing communities] (130,867,000 yen/2 places) [Urban parks] (2,527,398,000 yen/6 places)
Public housing etc. 422,393,000 yen	[Public housing] (422,393,000 yen/ Akamae-higashi Housing 9 houses, Omoe Housing 10 houses/ Completely destroyed, Onatsupe Housing 10 houses/Partially destroyed, Kanehama Housing 13 houses/Partially damaged, Anigata Apartment Housing 17 houses/Inundated above floor level)
Schools 210,292,000 yen	[Elementary Schools] (117,074,000 yen/Miyako Elementary School/Equipment damaged, Kuwagasaki Elementary School/Inundated above floor level, Structures damaged, Sokei Elementary School/Partially damaged, Yamaguchi Elementary School/Equipment damaged, Sentoku Elementary School/Partially damaged, Takahama Elementary School/Structures damaged, Akamae Elementary School/Structures damaged, Uiso Elementary School/Partially damaged, structures and equipment damaged etc., Uiso Elementary School Teachers' Housing/Completely destroyed, Chikei Elementary School/Partially damaged, structures and equipment damaged etc., Taro Daiichi Elementary School/ Partially damaged) [Junior High Schools] (92,065,000 yen/Daiichi Junior High School/Partially damaged, Omoe Junior High School/Structures damaged, Taro Daiichi Junior High School/Partially damaged, structures and equipment damaged etc.) [School meal centers] (1,153,000 yen/Niisato School Meal Center/Partially damaged, Omoe School Meal Center, Kawai School Meal Center/Equipment damaged)
Cultural properties 12,084,000 yen	[Nationally registered tangible cultural properties] (12,000,000 yen/Inundated above floor level) [Municipally designated tangible cultural properties] (84,000 yen/Destroyed)
Housing 149,605,110,000 yen	[Damage to housing etc.] (149,605,110,000 yen/5,968 houses/Completely destroyed, 1,335 houses/Severely destroyed, 1,174 houses/Partially destroyed, 611 houses/Partially damaged)
[Total estimated amount of damage: 245,660,884,000 yen]	

* Excluding damage to national/prefectural government facilities and that related to railroad, telecommunications, and electric operators

7. Chronology of Earthquakes and Tsunamis in the Miyako Area

● Apr. Jowa 6 (AD 839)
With earthquakes occurring frequently in the Mutsu Province, many peasants fled in fear. A request was made to Taga Castle and Isawa Castle to send reinforcement.

● May 26, Jogan 11 (AD 869)
A major earthquake in the Mutsu Province. Many people were crushed to death under collapsed houses. At Taga Castle, castle walls were damaged. A tsunami surged into the castle town, drowning over a thousand people.

● Nov. 23, Kyotoku 3 (AD 1454)
An earthquake hit the Kanto and Tohoku regions in midnight with a tsunami coming to the Oshu Province to carry away many people.

● Nov. 23, Keicho 13 (AD 1608)
A major earthquake in the Sendai Beach. Over 50 people and women died.

● Oct. 28, Keicho 16 (AD 1611)
A major earthquake in the Sanriku region with a tsunami rushing into the territories of Sendai, Morioka, Tsugaru, and Matsumae clans. At around 14:00, Kadoma (or Kasama), Kuroda, and Miyako were in uproar because of a major tsunami. When the floods mostly subsided at around 17:00, no houses remained around the seaside streets with many people drowned. Those who lost home were turned adrift. There were three earthquakes, followed by a major tsunami. The floods reached Fusagasawa in Yamada and Suzudo in Orikasa. Unosumai, Otsuchi, and Yokosuka saw 800 people dead with 50 people killed in Funakoshi, 2 in Yamada-ura, and 150 in Tsugaruishi. Many people died in Otsuchi and Tsugaruishi because it was a market day.

● Mar. 12, Enpo 4 (AD 1676)
In Nanbu Oura (or Aomori Prefecture), 20 private houses were swept away. There was no damage to people and horses.

● Mar. 12, Enpo 5 (AD 1677)
More than 20 earthquakes occurred from 20:00 until dawn. A major tsunami surged into every bay of the Kitahei area, carrying away houses, boats, and salt pans. At Miyako-dori, 55 boats were swept away, 56 houses damaged or carried away, and 16 salt pans damaged.

● Nov. 8, Genroku 12 (AD 1699)
A spring tide of the days 8 to 9 carried away houses and the like in some seaside areas. The floods reached Kubota-watari in Tsugaruishi, and came close to the Inari (Shrine) in Norinowaki. Fire broke out in Kuwagasaki-ura, burning down 20 houses and damaging 13. A small amount of rice from the shogunal storage was distributed among 159 people.

● Oct. 4, Hoei 4 (AD 1707)
An earthquake in Hachinohe. The neap tide level came close to the Minato Jubunnoichi Cottage.
Hoei Earthquake: a massive earthquake off of Enshu Nada to off the coast of Shikoku around 14:00.

● May 2, Kan-en 4 (AD 1751)
Around 14:00, the spring tide poured into Otsuchi-dori Street. Tidewater rose close to the floorboard, submerging fields, rice nurseries, and town alleys. As a result, 13 houses in Ureishi, 15 in Ryoishi-ura, 60 in Ando, 20 in Orikasa, and 50 in Osawa-ura were inundated below floor level.

● Dec. 16, Horeki 12 (AD 1762)
A major earthquake before night. In Hachinohe, various places were damaged. At Nanshuji Temple, the shrine and the Buddhist sanctum were damaged. On the day of 18th, a tsunami hit Minato Village, leaving behind seven boats destroyed and stranded. In Kuji Taneichi-dori, 13 destroyed boats became stranded. Dikes and bridges were damaged in several places. In Tanabe-dori and Nobechi-dori, many houses collapsed with fatalities. Kuwagasaki sustained greater damage than expected. At Akasaki-ura (or Akamae-ura), a net shed was damaged.

● May 3, Meiwa 9 (AD 1772)
A major earthquake at around 12:00. The Morioka Castle had its stone walls slightly damaged while the Hanamaki Castle sustained damage in various locations. In Nagasawa, Miyako-dori, there were people and horses killed. In Haratai Village, Taro Village, Nagasawa Village, Kawai Village, and Hakoishi Village, large rocks crumbled down with fatalities. Despite being a major earthquake, it was not followed by a tsunami. Legend has it that “Ancient people left a message that there is no tsunami when trees and plants are with green leaves.”

● Jan. 7, Kansei 5 (AD 1793)
Kansei Off the Southern Coast of Sanriku Earthquake. A major earthquake at around 12:00. Tsunamis surged into the Rikuchu, Rikuzen, and Iwaki Provinces. Areas under the jurisdiction of the Otsuchi-dori Governor's Office sustained devastating damage with 72 houses swept away, 11 houses damaged or destroyed, 47 boats carried away, and 11 people killed. In Miyako, the tsunami went upstream of the rivers for three or four times as people fled to the mountains. Miyako-machi, Fujiwara, and Sokei sustained no damage as high waves did not hit these areas. Minor earthquakes continued until mid-February. In Miyako and Fujiwara, people built huts in mountains to evacuate. The earthquakes had a hypocenter near the trench far away off the coast of Miyagi Prefecture.

● Oct. 11, Tenpo 8 (AD 1837)
In midnight, a tsunami surged into the Kesen District and Motoyoshi District, breaking through *Kawatome* implements for catching salmon in the Imaizumi River (Rikuzentakata City). The dikes around the Akasaki Salt Farms, Ofunato, gave way, leaving 2,000 bags of salt to be destroyed by the tsunami. It was strange that a tsunami came without a major earthquake.

● Mar. 26, Tenpo 14 (AD 1843)
There was a major earthquake at around 6:00. A tsunami rushed to the coast, damaging houses in Akamae. In Shirogane-mura, Hachinohe, the tsunami swept away fish manure, damaged about 14 to 15 huts on the seaside, and carried away small boats and sardine boilers.

○ Oct. 2, Ansei 2 (AD 1855)
Ansei Edo Earthquake. A major earthquake in Edo past 21:00 with the death toll being over 7,000.

● Jul. 23, Ansei 3 (AD 1856)
There was a strong earthquake at around 12:00, soon followed by a tsunami. The floods submerged the street in front of the Miyako Governor's Office. In Kuwagasaki, areas ranging from the vicinity of Kojima to Okuwagasaki (Hitachihama and Sumohama) were submerged. In the Kuwagasaki-ura, Takahama-ura, Kanehama-ura, and Akamae-ura, 108 houses were damaged.

● Jun. 15, Meiji 29 (AD 1896)
Meiji Sanriku Earthquake and Tsunami. At about 19:32, there was ground motion with a seismic intensity of 2 or so in the Sanriku Coast. About 30 minutes later, a raging tsunami came with furious sound, recording a maximum run-up height of 38.2 m in Shirahama, Ryori Village, Iwate Prefecture. The death toll rose to 22,000.

○ Sep. 1, Taisho 12 (AD 1923)
The Great Kanto Earthquake. At 11:58, there arose an earthquake with a magnitude of 7.9 with the hypocenter being at the western part of Kanagawa Prefecture. The death toll rose to 105,000 with an estimated number of completely destroyed houses being 110,000. It has become the worst natural disaster in the history of Japan due to firestorms in urban areas. A tsunami was generated in Sagami Bay.

● Mar. 3, Showa 8 (AD 1933)
Showa Sanriku Earthquake and Tsunami. At 2:31, there was heavy ground motion with a seismic intensity of 5 at the Sanriku Coast. In 30 minutes to within an hour, areas from Hokkaido to the Sanriku region were hit by tsunamis, leaving 1,408 people killed and 1,263 missing in Iwate Prefecture.

● May 24, Showa 35 (AD 1960)
Chilean Earthquake Tsunami. At 4:11 on the day of 23rd, the world's most powerful earthquake with a moment magnitude of 9.5 occurred off the coast of Valdivia, Chile, in South America. In midnight next day or 23 hours later, the resulting tsunami hit Japan, leaving 142 people killed or missing in six prefectures of Hokkaido to Chiba and Okinawa Prefecture.

● May 16, Showa 43 (AD 1968)
Off the Coast of Tokachi Earthquake. At 9:49, an earthquake with a magnitude of 7.9 occurred with a hypocenter being off the eastern coast of Aomori Prefecture. Areas from Cape Erimo in Hokkaido to the northern part of Iwate Prefecture sustained damage from ground shaking, while areas from Kushiro to the Pacific coast of Aomori, Iwate, and the northern part of Miyagi Prefecture sustained damage from a tsunami several meters high. Despite a tsunami height of over 5 m in Hachinohe, Noda, Miyako, Otsuchi etc., damage from the tsunami was slight because of the ebb tide and tsunami dikes that had been built.

● Jun. 12, Showa 53 (AD 1978)
Off the Coast of Miyagi Prefecture Earthquake. An earthquake with a magnitude of 7.4 with a hypocenter off Kinkasan Island occurred at 17:14. Areas centering on Miyagi Prefecture sustained damage. The earthquake hit the large city of Sendai with a population of over 500,000, revealing a low seismic resistance of the lifelines.

● Jun. 14, Heisei 20 (AD 2008)
Iwate-Miyagi Inland Earthquake. An earthquake occurred near the prefectural boundary of Iwate and Miyagi with a magnitude of 7.2. A seismic intensity of 6-upper was recorded in Oshu City, Iwate Prefecture, and Kurihara City, Miyagi Prefecture. The earthquake left 30 dwellings completely destroyed and 23 people killed or missing with landslides in highlands accounting for most of the damage.

* The month and day of occurrences that took place prior to the Meiji period are according to the Japanese calendar (lunar calendar), those of events in and after the Meiji period according to the solar calendar.
* Earthquake Research Institute, the University of Tokyo, ed., Historical Documents on Earthquakes in Japan, New Collection, is used as source book to compile a list of earthquakes and tsunamis for which damage to the Sanriku Coast was recorded (marked by ●). In addition, earthquakes and tsunamis that did not greatly affect the Sanriku region but are of historical importance are included in the list centering on those that hit the eastern part of Japan (marked by ○).
* For overview of earthquakes and tsunamis, Dictionary of Historical Disasters in Japan and Learning from the History of Disasters have been mainly used as reference.

References

1968 Off the Coast of Tokachi Earthquake Survey Committee. *1968 nen Tokachi oki Jishin Chousa Houkoku (1968 nen Tokachi oki Jishin Chousa Houkoku (1968 Off the Coast of Tokachi Earthquake Survey Report.)* Mar. 1969.

Central Meteorological Observatory, ed. *Kenshin Zihou (Quarterly Journal of Seismology.)* Vol. 7. KK. Sanshusha, May 1934.

Central Meteorological Observatory. *Sanriku oki Kyoushin oyobi Tsunami Gaihou (Summary Report on the Off the Sanriku Coast Massive Earthquake and Tsunami.)* Mar. 1933.

Central Meteorological Observatory. *Shouwa 8 nen 3 gatsu 3 nichi Sanriku oki Kyoushin oyobi Tsunami Houkoku (Report on the Off the Sanriku Coast Massive Earthquake and Tsunami on Mar. 3, 1933.)* Aug. 1933.

Civil Engineering Class, School of Engineering, Tohoku University, ed. *Touhoku Daigaku Kougaku bu Doboku Kyoushitsu Kenkyuu Houkoku Dai 21 gou 1968 nen Tokachi oki Jishin Chousa Houkoku (Research Report of Civil Engineering Class, School of Engineering, Tohoku University*. No. 21, *1968 Off the Coast of Tokachi Earthquake Survey Report.)* Mar. 1969.

Earthquake Disaster Prevention Survey Group, ed. *Dai Nihon Jishin Shiryou (Jyou Ge kan) (Historical Documents on Earthquakes in Japan.)* Work in two volumes. Maruzen Company, Limited, May 1904.

Earthquake Research Institute, the University of Tokyo, ed. *Shinshuu Nihon Jishin Siryou (Historical Documents on Earthquakes in Japan, New Collection*. Vols. 1-5. Earthquake Research Institute, the University of Tokyo, Mar.*)* 1981 onward.

Earthquake Research Institute, the University of Tokyo, ed. *Shinshuu Nihon Jishin Siryou Hoi (Supplements to Historical Documents on Earthquakes in Japan, New Collection.)* Mar. 1989.

Earthquake Research Institute, Tokyo Imperial University, ed. *Jishin Kenkyujyo Ihou Bessatsu Dai 1 gou Shouwa 8 nen 3 gatsu 3 nichi Sanriku Chihou Tunami ni Kansuru Ronbun Houkoku (Bulletin of theEarthquake Research Institute*. Vol 1, *Thesis Report on Mar. 3, 1933 Sanriku Region Tsunami.)* Iwanami Shoten, Publishers, Mar. 1934.

Editorial Group of the Omoe/Chikei Neighborhoods Kannon Statue Construction Executive Committee. *Dai Kaishou shi (Major Tsunami Report.)* Jun. 1982.

Historiographical Institute, the University of Tokyo. *Dai Nihon Siryou (Dai Nihon Siryo.)* University of Tokyo Press, Mar. 1906.

Itoko Kitahara, Ritsuko Matsuura, Reo Kimura, ed. *Nihon Rekishi Saigai Jiten (Dictionary of Historical Disasters in Japan*. Yoshikawa Kobunkan Kabushiki Kaisha, Jun. 2012.

Iwate Prefectural Library. *Iwate Shisou Dai 5 kan Naishiryaku (5) (Iwate History Collection*. Vol. 5, *History of Morioka Clan (5).)* Iwate Prefecture Cultural Properties Conservation Association, Aug. 1975.

Iwate Prefecture, ed. *Iwate-ken Shouwa Shinsai shi (Iwate Prefecture Showa Earthquake Disaster Report.)* Governor's Secretariat, Iwate Prefecture, Sep. 1934.

Iwate Prefecture. *Chiri Jishin Tsunami Saigai Fukkou shi (Chilean Earthquake Tsunami Disaster Reconstruction Report.)* Mar. 1969.

Iwate Prefecture. *Iwate-ken Higashinihon Daishinsai Tsunami no Kiroku (Iwate Prefecture Records of the Great East Japan Earthquake Tsunami.)* Mar. 2013.

Japan Meteorological Agency. *Kishou chou Gijutsu Houkoku Dai 133 gou Heisei 23 nen (2011 nen) Touhoku chihou Taiheiyou oki Jishin Chousa Houkoku Dai I hen (Technical Report of the Japan Meteorological Agency*. No. 133, *The 2011 Off the Pacific Coast of Tohoku Earthquake Survey Report, Part I.)* Dec. 2012.

Meiji News Dictionary Editorial Committee. *Meiji Nyu-su Jiten Dai 5 kan [Meiji 26 nen-Meiji 30 nen] (Meiji News Dictionary*. Vol. 5 [1893-1897].*)* Mainichi Communications Inc., Jan. 1985.

Miyako City Board of Education, ed. *Miyako Shishi Nenpyou (Miyako City History: Chronology.)* Miyako City,

Mar. 1991.
Miyako City Board of Education, ed. *Miyako Shishi Shiryou shuu (Kindai 1-2) (Miyako City History: Collection of Materials (Modern Period 1-2).)* Miyako City, Dec. 1999.
Miyako City Board of Education, ed. *Miyako Shishi Shiryou shuu (Kinsei 5) (Miyako City History: Collection of Materials (Early Modern Period 5).)* Miyako City, Mar. 1989.
Miyako City Board of Education, ed. *Miyako-shi no Ishibumi (Stone Monuments in Miyako City.)* Mar. 2010.
Miyako City, Iwate Prefecture. *Higashinihon Daishinsai no "Kiroku" ~Iwate-ken Miyako-shi~ (Records of the Great East Japan Earthquake: Miyako City, Iwate Prefecture.)* Mar. 2013.
Miyako City. *Kouhou Miyako (PR Miyako* (Jun. 1, 1968). Jun.*)* 1968.
Miyako City. *Kouhou Miyako (PR Miyako* (Jun. 1, 2011). Jun.*)* 2011.
Miyako City. *Miyako-shi Higashinihon Daishinsai Tunami Shinsuizu (Miyako City Great East Japan Earthquake Tsunami Inundation Maps.)* Sep. 2012.
Morioka City Board of Education. *Morioka han Karou seki Nikki Zassyo (Morioka Clan Chief Retainers' Diary: Miscellaneous Books.)* Vols. 16-25. Toyo Shoin, Jan. 2004-Oct. 2010.
Morioka City Central Public Hall. *Morioka han Zassyo (Morioka Clan: Miscellaneous Books.)* Vols. 1-15. Publishing Department, Kumagai Printing Kabushiki Kaisha, Feb. 1986-Dec. 2001.
Morioka Meteorological Office and Iwate Prefecture. *Iwate-ken Saii Nenpyou (Chronology of Disasters in Iwate Prefecture.)* Morioka Branch, Japan Weather Association, Jun. 1979.
Nanbu Collection Publication Group. *Nanbu Sousyo (1) (Nanbu Collection (1).)* Rekishi Toshosha Kabushiki Kaisha, Jan. 1970.
National Research Institute for Earth Science and Disaster Prevention. *Higashinihon Daishinsai Chousa Houkoku (Research Report on the 2011 Great East Japan Earthquake Disaster.)* Mar. 2012.
Nobuo Shudo et al., ed. *Tsunami no Jiten (Dictionary of Tsunami.)* Nov. 2007.
Ofunato City, Iwate Prefecture. *Chiri Jishin Tsunami 1960 Ofunato Saigai shi (Chilean Earthquake Tsunami in 1960: Ofunato Disaster Report.)* Jun. 1962.
Sadao Tamogi. *Tono ga Unda Senkakusha Yamana Soshin (Soshin Yamana: A Pioneer Born in Tono.)* Mar. 1986.
Sendai Regional Headquarters, Japan Meteorological Agency. *Shouwa 35 nen 5 gatsu 24 nichi Chiri Jishin Tsunami Chousa Houkoku (May 24, 1960 Chilean Earthquake Tsunami Survey Report.)* Jan. 1961.
Shiroi Kunino Uta, ed. *Hoppou no Jidou Bunshuu Iwate hen (Anthology of Prose Works by Children in the North: Iwate Part.)* Tohoku Electric Power Co., Inc., Jun. 2008.
Showa News Dictionary Editorial Committee. *Shouwa Nyu-su Jiten Dai 4 kan [Shouwa 8 nen- Shouwa 9 nen] (Showa News Dictionary.)* Vol. 4 [1933-1934]. Mainichi Communications Inc., Jun. 1991.
Takahama Self-Governing Body. *Tsunami Kinen shi Chiri Jishin Tsunami yori 30 nen Ano Sanjou wo Furikaette (Tsunami Memorial Publication: Looking Back on Tragic State of the Chilean Earthquake Tsunami after 30 Years.)* Feb. 1991.
Taro Junior School. *Shouwa 9 nen 3 gatsu 3 nichi 1 Kaiki Kinen Taro-mura Tsunami shi Taro Shougakko hen (In Commemoration of First Anniversary of Mar. 3, 1934, Taro-mura Tsunami Report: Taro Elementary School Part.)* Sep. 1934.
Taro-cho Board of Education, ed. *Taro-cho shi Tsunami hen (Taro-cho Tsunami shi) (Taro-cho History: Tsunami Part (Taro-cho Tsunami Report).)* May 2005.
Taro-cho Board of Education. *Denbun Furusato Tsunami shi (Sanriku Otunami) (Home Town Tsunami Hearsay Report (Sanriku Major Tsunami).)* Mar. 1991.
Taro-cho History Editorial Committee. *Taro-cho shi (Dai 1 Shuu) Bousai no Machi (Taro-cho History (First Series) Town of Disaster Prevention.)* Sep. 1971.
Tohoku Culture Study Group, Tohoku University, ed. *Ezo Shiryou (Historical Documents on Ezo.)* Yoshikawa Kobunkan Kabushiki Kaisha, Sep. 1957.
Tono Municipal Tono Culture Research Center. *Fukkoku ban Meiji 29 nen Fuuzoku gahou Rinzi zoukan Dai*

Kaishou Higai roku Mayohiga Tono bunka Tomono kai Kaihou Vol. 2 (Tono Culture Fellowship Bulletin Mayohiga. Vol. 2, Reprinted Edition of *Manners Graphic Magazine*, Extra Edition (1896), *Major Tsunami Damage Records.)* Araemishi, Mar. 2012.

Town Information Corporation. *Gekkan Miyako Waga Machi 2013/9 No. 417 (Monthly Miyako My Town. No. 417 (Sep. 2013).)* Aug. 2013.

Yaichiro Yamaguchi. *Tsunami to Mura (Tsunami and Villages.)* Koshunkaku Shobo, Sep. 1943.

1968 Off the Coast of Tokachi Earthquake Survey Committee. *1968 nen Tokachi oki jishin Chousa Houkoku (1968 Off the Coast of Tokachi Earthquake Survey Report.)* Mar. 1969.

Cooperators (titles omitted)

Organizations

The General Disaster Management Office, General Affairs Department, Iwate Prefecture
The Japan Meteorological Agency
Morioka Meteorological Office, the Japan Meteorological Agency
The Emergency Disaster Patrol Department, the National Police Agency
The Geospatial Information Authority of Japan
National Diet Library
Town Information Corporation
Taro Fishery Cooperative
Earthquake Research Institute, the University of Tokyo
The 2011 Tohoku Earthquake and Tsunami Joint Survey Group
World Vision Japan
National Research Institute for Earth Science and Disaster Prevention
Miyako Fishery Cooperative
Iwate University

Individuals

Hitoshi Maekawa
Kaoru Wada

Miyako City Great East Japan Earthquake and Tsunami Records Editorial Committee

(Editorial committee members)

	Name	Title/organization
Chair	Yoriko Kanda	Professor, Faculty of Humanities, Keiwa Gakuen College
Vice chair	Masaaki Minami	Professor, Faculty of Engineering, Iwate University
Member	Naoyuki Ogawa	Professor, Faculty of Letters, Kokugakuin University
Member	Hiroshi Hirai	Associate professor, Faculty of Engineering, Iwate University
Member	Shoichi Kishi	Former manager of Miyako City History Editorial Office

(Editorial supervisor)

Name	Title/organization
Tomoko Yamazaki	Professor, Faculty of Education and Research Center for Regional Disaster Management, Iwate University

(Secretariat)

Name	Title/organization
Noboru Sakashita	General manager of General Affairs and Planning Department (FY 2012-13)
Hiroaki Sato	General manager of Education Department (FY 2012-13), general manager of General Affairs and Planning Department (From FY 2014 onward)
Tatsuyuki Kumagai	General manager of Education Department (From FY 2014 onward)
Masanori Yamazaki	Manager of Planning Section, General Affairs and Planning Department
Masao Takeshita	Manager of Culture Section, Board of Education
Hiroshi Mikawa	Chief in charge of public relations, Planning Section (FY 2012)
Fujiharu Tanaka	Chief in charge of public relations, Planning Section (From FY 2013 onward)
Yoshiaki Kawauchi	Chief in charge of public relations, Planning Section
Yuichiro Kariya	Chief, City History Editorial Office, Culture Section, Board of Education

The Great East Japan Earthquake and Tsunami: Records of Miyako City.

Vol. 1, History of Tsunami (Summary Version)

Issued on Sep. 1,2014
- Japanese Edition Sep. 1,2014
- English Edition Mar.15, 2015

Editor : Miyako City Great East Japan Earthquake and Tsunami Records Editorial Committee
Publisher : Miyako City
2 − 1 Shinkawa-cho, Miyako City
Printer : Bunka Insatsu Kabushiki Kaisha
5 − 13 − 6 Matsuyama, Miyako City