Impact of the Great East Japan Earthquake on Zostera meadows in the coastal area close to the epicenter

Daisuke Muraoka*, Tomoko Sakami, Goro Yoshida, Masakazu Hori, Hiromori Shimabukuro, Takehisa Yamakita and Hitoshi Tamaki

*Tohoku National Fisheries Research Institute, Fisheries Research Agency, Japan

Photo taken by an employee of Miyako City, Iwate Prefecture
Topics

• General review of the Great East Japan Earthquake → What happened on March 11th, 2011?

• Effects on Zostera meadows in an inland bay area (Zostera marina community)

• Summary and the future research

Photo taken by MAINICHI SHINBUN PUBLISHING CO.
Topics

• General review of the Great East Japan Earthquake ➔ What happened on March 11th, 2011?

• Effects on Zostera meadows in an inland bay area (Zostera marina community)

• Summary and future research
Review of the Great East Japan Earthquake

- Magnitude 9.0 (March 11th, 2011) earthquake occurred off the Pacific coast of Eastern Japan
- Height of Tsunami: 10m or over
- Land flooded: 561km²
- Houses destroyed: Approx. 100,000
- Fishing boats destroyed: Approx. 22,000
- Economical loss: $200-300 billion (USD)
- People dead or missing: Approx. 20,000
- Nuclear Power Plant Accident in Fukushima

What were the effect on the Zostera meadows?
Topics

• General review of the Great East Japan Earthquake → What happened on March 11th, 2011?

• Effects on Zostera meadows in an inland bay area (Zostera marina community)

• Summary and future research
The function of Zostera meadows

PICES-2012 S11
MURAOKA et al.
Epicenter

About 130km

Miyagi Prefecture

PICES 2012 S11
MURAOKA et al.
Research points in Miyagi Prefecture

① Matsushima bay
② Samenoura bay
③ Mangokuura (inland sea)
Distribution of Zostera meadows (before the earthquake, June 2007)
Zostera meadows: 0.023 km²
Only 1% survived!

April 12th, 2011 (one month later)

Distribution of Zostera meadows (after the earthquake, May 2012; by E-TEC)
Seedlings in Matsushima bay
April 26th, 2012

Zostera meadow was destroyed by the Tsunami (1.6m depth)
Research points in Miyagi Prefecture

① Matsushima bay
② Samenoura bay
③ Mangokuura (inland sea)
Crustal movement

Maximum: 1.2m in Oshika Peninsula

Horizontal

Vertical (downward)

Geospatial Information Authority of Japan
A port in Oshika peninsula

June 8th, 2011 (after the earthquake)
② Samenoura bay
June 2\textsuperscript{nd}, 2010 (before the earthquake)

PICES-2012 S11
MURAOKA et al.
Sept. 8\textsuperscript{th}, 2011 (after the earthquake)

PICES-2012 S11
MURAOKA et al.
August 9th, 2011
(after the earthquake)
Crustal movement

Maximum: 1.2m in Oshika Peninsula

Horizontal
Vertical (downward)

Geospatial Information Authority of Japan
June 2nd, 2010 (before the earthquake)

PICES-2012 S11
MURAOKA et al.
Sept. 8\textsuperscript{th}, 2011 (after the earthquake)

PICES-2012 S11

MURAOKA et al.

Line transect research
Surviving *Zostera* in Samenoura Bay
Coverage change of *Zostera* before and after the earthquake

![3D graph showing coverage change of Zostera over time and positions on the fixed line.](image)

- **Coverage (%)**
- **Positions on the fixed line (m)**
- **Dates:**
  - Jan-12
  - Jul-12
  - Aug-11
  - Jun-06

**Authors:** PICES-2012, S11, MURAOKA et al.
Percentage of silt (<0.075mm) in the sediment before and after the earthquake

**PICES-2012**

**MURAOKA et al.**
Research points in Miyagi Prefecture

① Matsushima bay
② Samenoura bay
③ Mangokuura (inland sea)
Mangokuura

PICES-2012 S11

MURAOKA et al.
June 15th, 2011
Researched by SCUBA

PICES-2012 S11
MURAOKA et al.

165 shoots/m² in average
March 19th, 2011 (right after the disaster)

February 22th, 2012 (about one year later)
Crustal movement

0.9m in Mangokuura

Horizontal

Vertical (downward)

Geospatial Information Authority of Japan
Topics

- General review of the Great East Japan Earthquake → What happened on March 11th, 2011?
- Effects on Zostera meadows in an inland bay area (Zostera marina community)
- Summary and the future research
Summary

• *Zostera* meadows: destroyed in most areas by Tsunami → self restoration (Seedlings in Matsushima bay etc.)

Environmental changes: downward of the basement, landslide, etc.

Long-term observation is necessary!