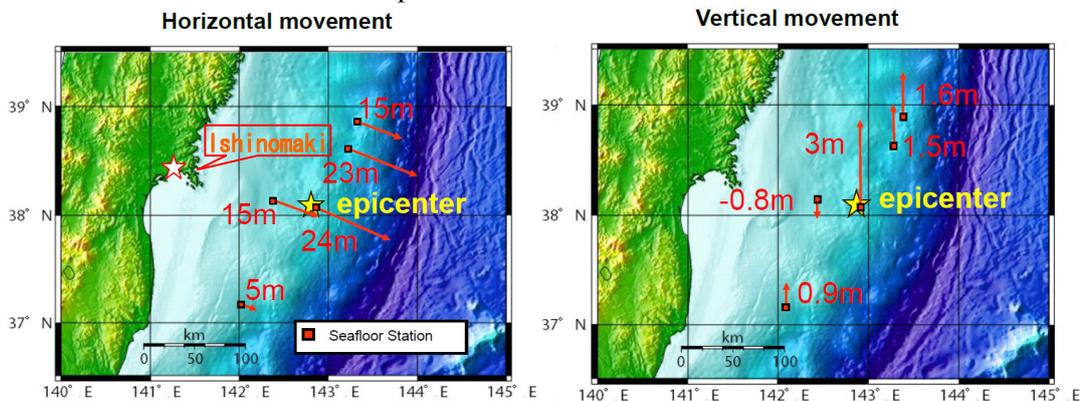


Chart action taken after the great Earthquake and the great Tsunami

1. Seafloor movement caused by the Earthquake

JHOD detected the maximum movement about 24m toward ESE and about 3m upward near the epicenter after the Great East Japan Earthquake. Significant subsidence of ground level has been also reported in the harbours in the east coast of Japan.

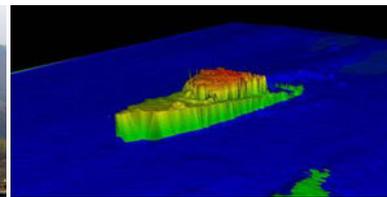


2. Flow out caused by the Tsunami

The breakwaters protecting these harbours, quays, and aids to navigation were devastated by the tsunami. Cars, containers, harbour facilities, and debris of devastated houses, were swept away to these ports and coastal areas, so powerful that water depth in the harbours might be changed.

3. Emergency survey of open for navigation

In order to secure emergency transportation routes by sea, JHOD carried out emergency surveys around the shipping lanes in ports.



Sunken ship identified by multi-beam echo sounders

Obstacles survey

4. Obstacles clearance operation

The port authorities removed the obstacles in the shipping lanes quickly.

Removal of the obstacles



Container



Sunken ship



Car

5. Hydrographic survey to publish to New Edition of the Charts

After removal of the obstacles, JHOD carried out the hydrographic survey at each harbour once again, following the datum level determination after the earthquake in order to revise the nautical charts. The surveyed data analysis indicated the following.

- 1) Water depths in all the surveying areas were changed by the crust movement.
- 2) Small foul bottoms were observed in many parts of the channels.

In a new edition of a chart, JHOD adopted the ZOC diagram. The category ZOC 'U' was assigned to unsurveyed area, because it is extremely difficult to assess the accuracy of the past surveys.

Surveyed and Unsurveyed Area (ISINOMAKI)

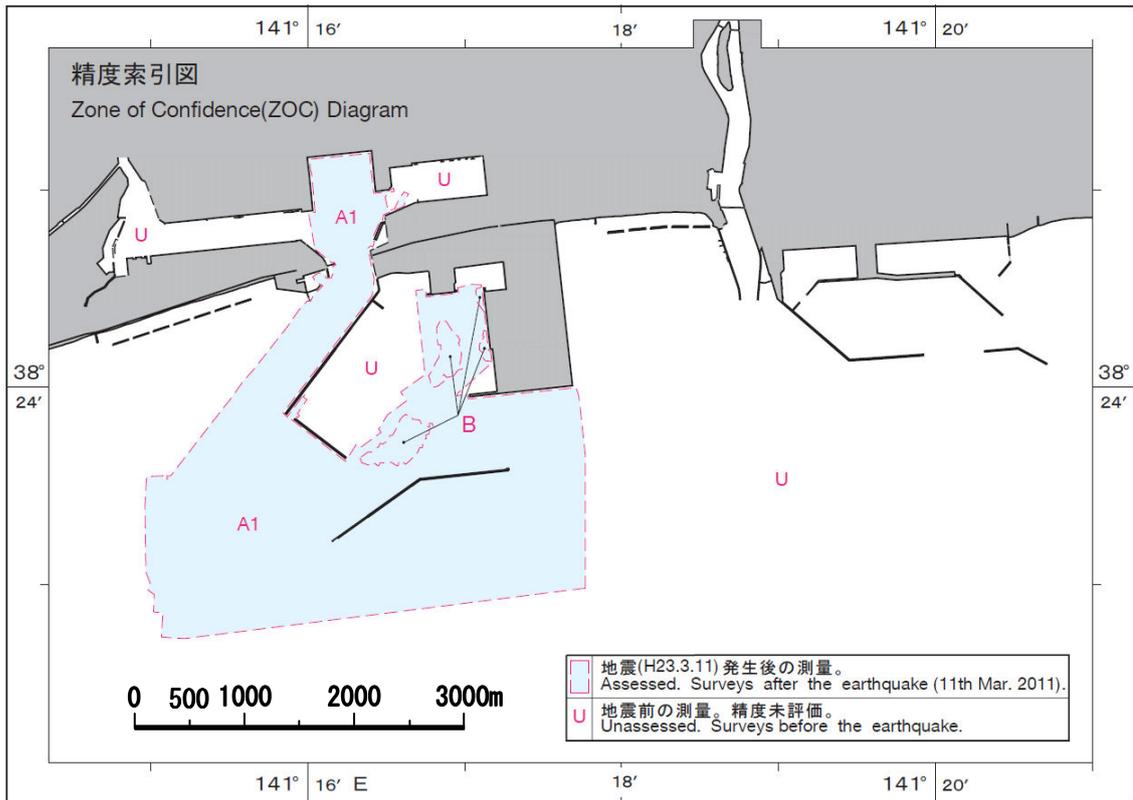


Fig. 1 ZOC Diagram of Chart W1100 "ISINOMAKI"

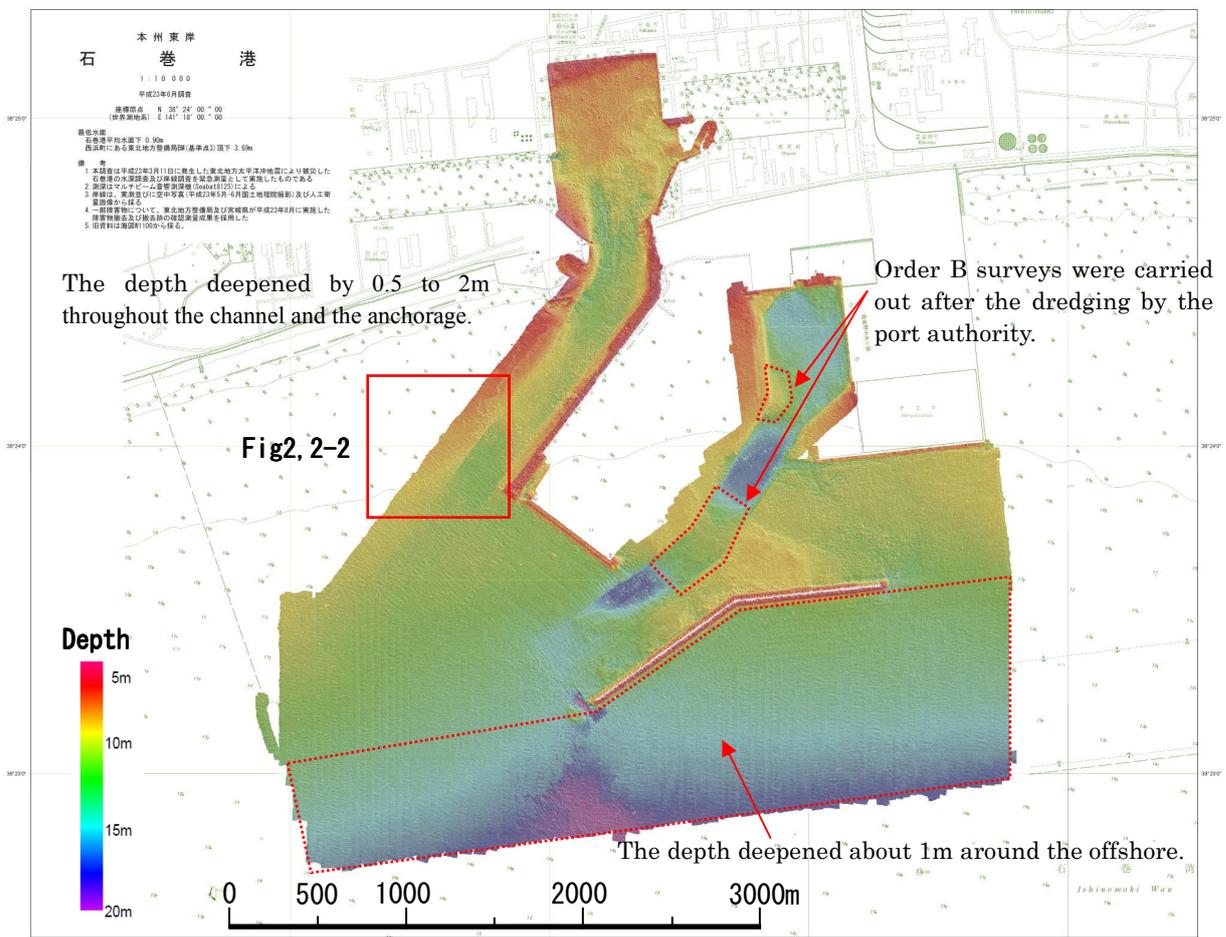


Fig. 1-2 Surveyed and Unsurveyed Area "ISINOMAKI"

E211005A

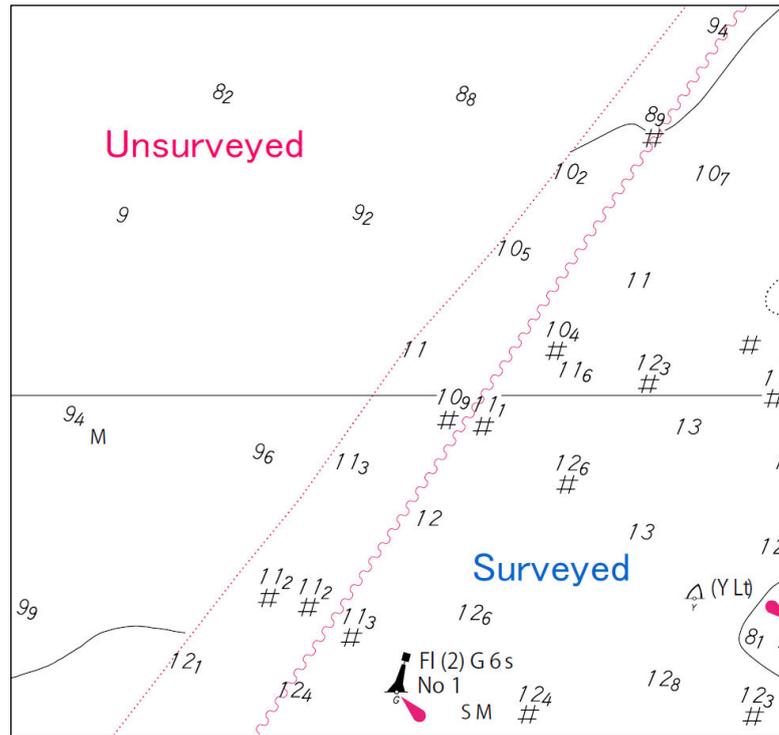


Fig. 2 Magenta dotted lines to inform limit of survey area on the chart “ISHINOMAKI”

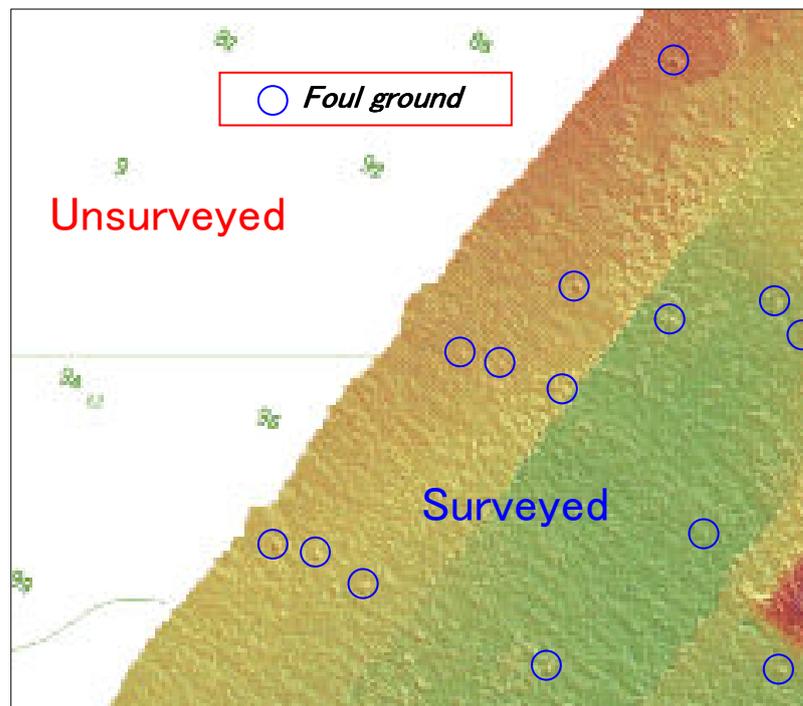


Fig. 2-2 Identified 'Foul ground' in surveyed area “ISHINOMAKI”

We observed small foul bottoms over 250 places of the surveyed area.