東北地方太平洋沖地震による漁港漁場漁村被害の特徴と復旧

独立行政法人水産総合研究センター水産工学研究所
中山哲巖・明田定満*・八木　宏・浅川典敬・桑原久実・澤田浩一

和文要旨

3 月 11 日に発生した東北太平洋沖地震の発生に伴い、大津波が震源域に近い東北太平洋沿岸域を襲い、漁業地域に未曾有の大被害を与えた。現時点でも、漁業地域の本格的な復興の道筋が未だ見えない状況にある。

（独）水産総合研究センター水産工学研究所（以下我々と称する）は、震災発生以来、水産庁の委託を受けて、漁港施設の設計基準の見直しに向けて、調査団を編成し、青森県から千葉県に至る 12 漁港において漁港施設の被災調査を行い、地震・津による漁港施設の被災機構の検討を進めている。さらに、岩手県、宮城県の 3 漁場において、漁場内の瓦礫分布調査を行った。

具体的な調査としては、地震前後における漁港施設の変状調査、防波堤の倒壊状況調査、津波痕跡調査、液状化の実態把握等である。さらに、今回の震災において、地震・津波による被災機構の典型的な被災事例として、岸壁背後の床版流出を取り上げ検討した。現在、漁港施設の被災事例の詳細な検討に基づき、現行の漁港施設の設計基準の是非について検討するとともに、津波防災の観点から、漁港施設の計画と設計上の問題点を抽出し、今後の漁港施設のあり方を検討している。一方、沿岸域の漁業生産力の回復のために、水中音響機器を用いて、漁業の再開を妨げる漁場内の瓦礫分布調査を行ない、海底地形図と瓦礫分布図を作成した。

調査結果の概要は以下の通りである。

（１）　地震力による被災事例として岸壁等の係留施設を調査し、津波力による被災事例として防波堤等の外郭施設を調査した。

（２）　係留施設については、矢板構造、杭式構造、重力式構造等の構造形式により被災状況が異なること、地震により損傷を受けた施設が、津波によりさらなる壊滅的な損傷を受けたこと、耐震強化岸壁は地震後も健全な状態であったことが明らかになった。

（３）　外郭施設については、水中音響機器を用いて被災状況を確認したところ、漁港施設の倒壊は津波の押し波か、引き波の何れかで被災したこと、倒壊時の外力は漁港条件により異なることが明らかになった。

（４）　海岸保全施設については、三面張構造の施設が越流により壊滅的な被災を受けたこと、津波の遡上と津波浸水高を軽減することが明らかになった。

（５）　漁港施設の被災の程度は、壊滅的な破壊から応急復旧可能な軽微なものまで幅広い。漁港施設の復旧に際して、今後の漁港施設は、壊滅的な損傷を被ることなく、応急復旧可能な“粘り強い”構造物であることが重要である。

（６）　網やロープ等の多くの漁業資材が漁場内に散乱している。瓦礫は湾奥部に多く、湾口部に少ない。

本論では、漁港施設等の被災状況及び瓦礫分布状況を報告するとともに、今般の被災により判明した漁港施設の弱点を指摘することにより、今後設計基準の見直し等を検討する上での技術的な提案を行いたい。

The characteristics of damage and the restorations of the fishing port, fishing ground and fishing village by the 2011 off the Pacific coast of Tohoku Earthquake

National Research Institute of Fisheries Engineering (NRIFE), Fisheries Research Agency (FRA)
Akiyosi Nakayama, Sadamitsu Akeda*, Hiroshi Yagi, Noritaka Asakawa, Hisami Kuwahara and Kouichi Sawada

Abstract

At 11 March 2011, with the outbreak of “the 2011 off the Pacific coast of Tohoku Earthquake”, the giant tsunami attacked the Tohoku Pacific coastal areas near the hypocentral region, and gave serious damage to most of the fishing ports, fishing grounds and fishing villages in these areas. Now, the state does not yet show a process to all-out revival of the fishing village areas.

Since the outbreak of the earthquake, for the review of the design standard of the fishing port structures, By trust of the Fisheries Agency, NRIFE (hereinafter referred to as we) organized investigation groups, surveyed the damage of fishing port structures at 12 fishing ports from Aomori to Chiba. We have been investigating the collapsed mechanism of fishing port structure by the earthquake and the tsunami. In addition, we surveyed the debris distribution at three fishing grounds in Miyagi & Iwate. Specifically, we surveyed the displacement of the fishing port structures before and after the earthquake, the collapsed state of the breakwaters, the trace of the tsunami that run up on land, the actual state of liquefaction and so on. As the typical example on the f collapsed mechanism caused by the earthquake and the tsunami, we have investigated the outflow of concrete slabs laid behind quays. Based on the detailed examination of the damage examples of the fishing port structure, we have been evaluating the appropriateness of the current design standard. We have found the problems on the planning and design of the fishing port structure, have investigated the way of fishing port structure that should be in future, from the viewpoint of disaster prevention against the tsunami. On the other hand, to restore of the fishery production in these areas, we have surveyed the debris distribution that disturbed the reopening of the fishery using underwater acoustic equipment, and have made the topographical map of the sea bottom, and debris map in the fishing grounds.

The outlines of the investigation are as follows. (1) We surveyed the mooring facilities such as quay, as damage examples of the fishing port structure caused by earthquake, the outlying facilities of port such as breakwater, as damage examples of the fishing port structure caused by Tsunami. (2) In the mooring facilities, we made clear that the damage state varied according to structural types such as sheet pile structure, pile structure, gravity structure and so on, the structure damaged by the earthquake received further destructive damage by the tsunami, and the earthquake resistant quay maintained in healthy state after the earthquake. (3) In the outlying facilities, we surveyed the damage state of the breakwater using underwater acoustic equipment. We made clear that one of the compression waves or backwash waves of the tsunami caused the collapse of breakwater, and the collapsed wave of the breakwater varied according to the condition of the fishing port. (4) In the coastal protection facilities such as seawall, we made clear that the coastal protection facilities of three surfaces armoring received destructive damage by overflow; but the coastal protection facilities reduced the run-up of the tsunami and the tsunami flood depth. (5) The damaged degree of the fishing port facilities exists widely from devastating to slight which can restore temporarily. In the restoration of the fishing port facilities, the future fishing port facilities does not suffer destructive damage, and it is important to be tough structure that can restore temporarily. (6) Many fishery materials such as nets or ropes were scattered in the fishing grounds. They were much in the inner bay, but were little in the mouth of bay.

In this paper, we report the damage state of the fishing port structures, point out the weakness of the fishing port structure that became clear by this disaster, and suggest a technical proposal to examine the revision of the design standard. Furthermore, we report the debris distribution in the fishing grounds.