

学校编码：10384

密级\_\_\_\_\_

学号：22620111151434

厦 门 大 学

硕 士 学 位 论 文

基于数值模拟的海湾围填海工程环境容量  
价值损失评估研究

——以福建省沙埕港围填海工程为例

Environmental Capacity Value Loss Evaluation Research of  
Coastal Reclamation Projects in Bay Based on the  
Numerical Simulation

——Case Study of Shacheng Harbor in Fujian Province

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论文提交日期：2014年4月

论文答辩时间：2014年5月

2014年5月

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厦门大学博硕士学位论文摘要库

## 摘 要

海洋不仅为人类提供了丰富的生产、生活资料和广阔的空间资源，而且还提供了许多的生态系统服务，废弃物处理就属于其中的一项，人类生产、生活产生的废水、废气、废渣等通过地表和地下径流、排泄、淋滤、大气沉降等方式直接或间接进入海洋，就某一个特定海域来说，通过对排入其中的污染物进行自然缓冲、净化和同化，使该海域具有一定的承受量或负荷量，这种承受量或负荷量称之为海域环境容量。

海洋环境资源长期以来一直被无偿或低偿使用，海域环境容量是一种有限的环境资源，某一海域消纳污染物能力的大小受到本身自然条件的制约，大规模的填海造地工程将会越来越凸显海域环境容量的稀缺性。本文拟从围填海工程对海湾环境容量价值损失评估的角度出发，运用数值模拟的方法，从理论分析、评价方法以及案例研究等几个方面，对围填海工程引起的海湾环境容量价值损失进行评估，具有明显的现实意义和学术价值。

本文在归纳总结国内外水环境容量和水环境容量价值（包括海域环境容量和海域环境容量价值）理论和实践研究进展的基础上，基于环境经济学、物理海洋学、环境科学和环境管理学等多学科的理论，采用文献查询、资料收集、理论分析、模型构建和案例研究相结合的手段展开研究。探讨了海域环境容量价值的定义以及基本特征，在相关理论研究的基础上构建了海湾围填海工程环境容量价值损失评估模型，并以福建省沙埕港海域围填海工程为例展开了相关研究。论文取得了以下研究成果：

第一，通过对国内外相关文献资料的查阅、回顾和总结，界定海域环境容量价值的定义，分析海域环境容量的基本特征，并在此基础上运用效用价值论、劳动价值论和生态环境价值论探讨海域环境容量的价值存在、构成以及影响其价值大小的因素。

第二，通过查阅相关文献，归纳总结出影子价格模型、替代市场法模型和模糊综合评价模型三种评估海域环境容量价值方法的优缺点，并结合围填海工程的特殊情况（对于一定时期的围填海工程而言，该时期内的经济、社会和科技条件可以视为不变，围填海工程导致的海湾环境容量价值的损失仅与自然因素的改变有关），在此基础上构建了围填海工程造成的海湾环境容量价值损失的评估模型。

第三,详细介绍了二维正压深度平均流水动力数值模型及其与污染物扩散的耦合模型。选择福建省沙埕港海域的围填海工程作为研究案例,将构建的模型和方法体系应用于该案例研究中,得出围填海工程造成的海湾环境容量价值的损失值。结果显示,围填海工程造成的海湾环境容量价值的损失是非常巨大的,高达57245.9764 万元/a,单位面积损失值 60.32 元/(m<sup>2</sup>·a),并与沙埕港海域使用金征收标准进行了比较,得出海域使用金征收标准偏低的结论。本文建议有关的行政主管部门要组织相关的专家学者深刻研讨、调查研究并在广泛的公众参与的基础上科学合理地制定填海造地海域使用金征收标准,并尽快开始征收海洋生态补偿金,真正体现海洋环境容量资源的价值,使围海造地带来的损失降到最低,调控围填海需求、保障海洋环境可持续发展。

**关键词:** 海域环境容量; 价值损失评估; 围填海工程; 水动力模型; 污染物扩散模型

## **Abstract**

The marine not only provided abundant production and living materials and expansive space resources for human, but also afforded a number of ecosystem services. Waste disposal was one of them. Waste water, gas and residue that generated from human's production and living activities directly and indirectly entered the sea through the earth's surface and underground runoff, excretion, leaching and atmospheric precipitation. In terms of a particular sea area, its ability to buffer, assimilate and purify the sea garbages, making it have a certain capacity and loading to them, and generally called this as the marine environmental capacity.

Marine environmental resources had long been used by free or a little payment. Marine environmental capacity was a limited environmental resource, the ability to degrade the pollutants limited by its natural conditions for a sea area. Reclamation Projects would make the scarcity of marine environmental capacity more and more highlighted. This article prepared on the perspective of environmental capacity value loss evaluation caused by recalcation projects in bay, using numerical simulation method, through theoretical analysis, evaluation method and case study to evaluate the marine environmental capacity value loss caused by recalcation projects. This research had obviously practical significance and academic value.

This paper summarized the domestic and foreign theory and practice of water environmental capacity and water environmental capacity value, including marine environmental capacity and marine environmental capacity value. Based on environmental economics, physical oceanography, environmental science, environmental management and other multi-disciplinary theory, through literature query, data collection, theoretical analysis, model building and case study to carry out the research. This essay discussed the definition and basic characteristics of marine environmental capacity value, constructed the evaluation model of marine environmental capacity value loss caused by recalcation projects in bay based on some related theory, and took an example of Shacheng Harbor in Fujian province for case research. The main achievements of the dissertation were as follows:

Firstly, by means of consulting, reviewing and summarizing domestic and foreign literatures, this paper defined the definition of the marine environmental capacity value, analyzed marine environmental capacity's basic characteristics and applied the utility value theory, label value theory and ecological environment value theory to explore the exist, composition and various factors which affect the value size of marine environmental capacity.

Secondly, through consulting related literatures, this paper summed up the advantages and disadvantages of shadow price model, alternative marketing model and fuzzy comprehensive evaluation model which were used to evaluate the marine environmental capacity value. In consideration of the special situation of reclamation projects, that was to a certain period of reclamation projects, the economy, society, science and technology conditions could be regarded as the same, so the marine environmental capacity value loss caused by reclamation projects only related to the change of the natural factor, and then built the evaluation model of marine environmental capacity value loss caused by recalamation projects in bay.

Thirdly, two dimensional barotropic average water depth hydrodynamic model and its coupling with pollutant diffusion model was introduced. Choosing reclamation projects in Shacheng Harbor of Fujian province as study case, applying the model and method into this case, and finally got the result of environmental capacity loss value caused by reclamation projects in Shacheng Harbor. The result showed that the loss value was very large, as high as 572.459764 million yuan per year, and the loss value per unit area was 60.32 yuan per square meter per year. Comparing to the sea area use fee in Shacheng Harbor, the value loss was higher than it. Therefore, the relevant administrative department should organize experts and scholars to do deep research and investigation, and scientifically and reasonably formulated the standard of sea area use fee to reclamation projects on the basis of extensive participation. Then the marine ecological compensation fee should been collected as soon as possible so that it could really reflect the value of marine environmental capacity resources and make the losses from reclamation to the minimum, controlled reclamation requirements and guaranteed the sustainable

development of the marine environment.

**Key Words:** Marine Environmental Capacity; Value Loss Evaluation; Reclamation Projects; Hydrodynamic Model; Pollutant Diffusion Model

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