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국립수산과학원
National Fisheries Research &
Development Institute



2008 Qingdao, China

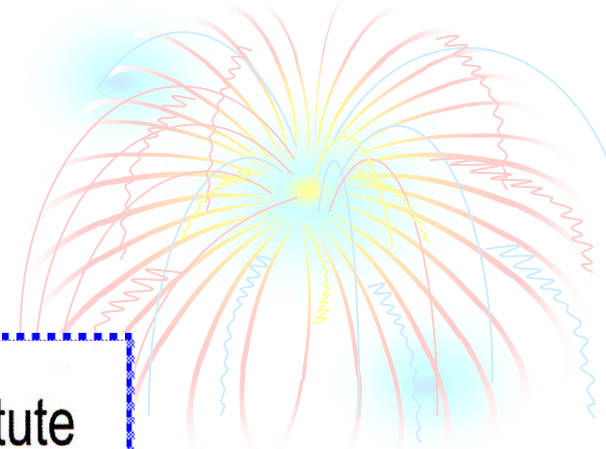
Development of Artificial Reefs in China

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Research on: Fishery Engineering

At present, mainly on R&D of offshore cage and artificial reef technology

MAIN CONTENTS



- Introduction**
- Development Status**
- Types and Materials**
- Development in Coast of Shandong**

I Artificial Reefs and Their Functions



- **Artificial reefs**—

are man-constructed objects in waters to make a better habitat environment for aquatic organisms and to provide fish a ground for feeding, reproduction and growing up so as to protect and enhance fishery resources and improve the quality of catches

- **Why artificial reefs have the function?**

According to the experiments and deductions of some experts, we summarized the mechanism of artificial reefs as following 5 points:

I Artificial Reefs and Their Functions



➤ **Natural behaviors or instincts of marine animals**

Experiments proved that most of fishes like moving towards the objects in waters

➤ **Effect of current**

Artificial reefs make the current change and the flow of current brings nitrate and phosphate up. Thus feeds are abundant

➤ **Effect of feeds**

Algae and other organisms grow on the reefs which provide fishes habitat and enough feeds

➤ **Effect of shadows**

Some of the sea animals like staying in shadows, holes and slots

➤ **Effects of shelters**

Reefs provide hiding and escaping places for fishes when attacked by enemy animals

II Status and Development of Artificial Reefs

1. General description in foreign countries

● Construction of artificial reefs in Japan

1976-1982 1511 billion (Japanese Yen)

1983-1987 2290

1988-1993 3299

1994-2000 4908

Total 11860 billion

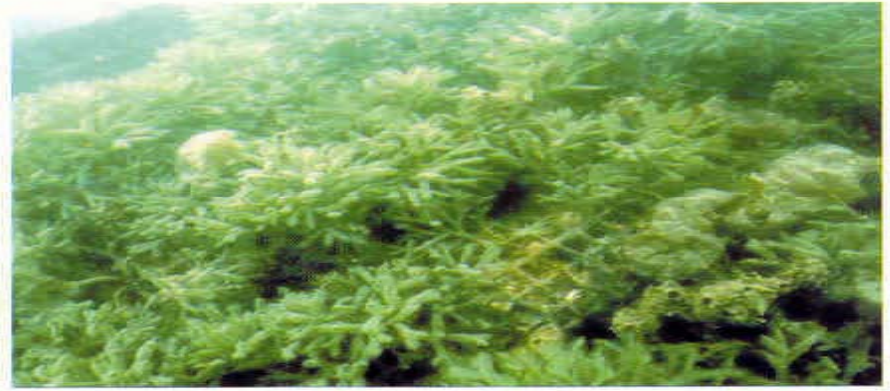
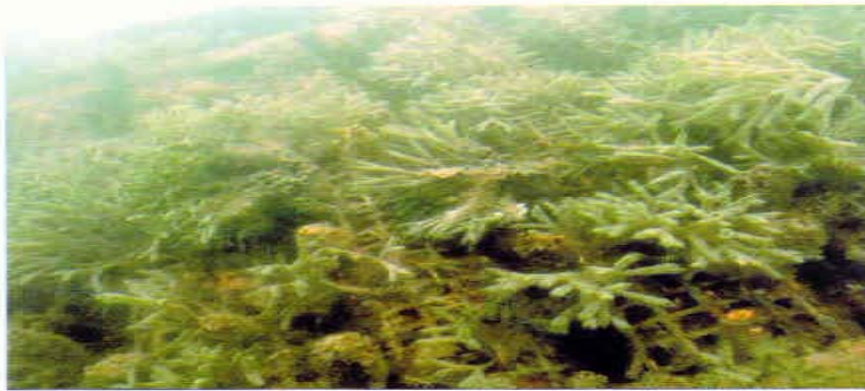
By the year of 2000, 53 million m³ of artificial reefs had been set up and the total area of artificial reefs accounts for 12.3% of the coastal fishing area of Japan.

From 2001, Japan began to construct artificial reefs in deeper water areas (40-70m)

Japan is the earliest and most successful country in the construction of artificial reefs

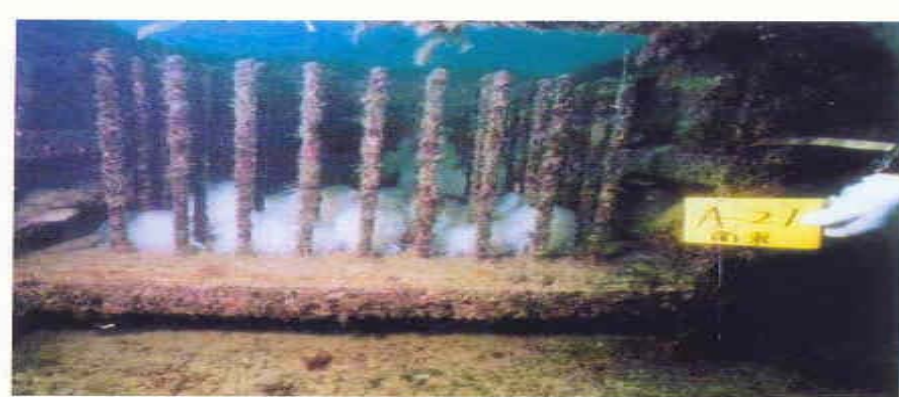


Algae growing well in reef areas (Japan)



Algae growing well in reef areas (Japan)





Cuttlefish spawning in reef areas (Japan)



Cuttlefish spawning in reef areas (Japan)



II Status and Development of Artificial Reefs



- **The United states of America**

Artificial reef construction in America has a history of more than 100 years and mainly for the development of angling fishery and tourism

- **Other countries and regions**

Korea, Australia, Malaysia, Thailand

Taiwan of China, HongKong etc.

II Status and Development of Artificial Reefs



2. General description of China

China started the experimental studies on artificial reefs in 1979, when the first set of artificial reefs was put into sea in the Bay of Beibuwan in Guangxi Zhuang Autonomous Region. **Generally, the development of artificial reefs in China can be divided into three periods:**

First period(1979~1986): Experimental stage and the construction of artificial reefs in small scale, but acquired rich materials and experiences both in the theory and practice.

Second period(1987~2000): Stopped for some reason

Third period (from 2000): Studies, experiment and large scale construction of artificial reefs are carrying out all over the coastal areas of China.

III Types and Materials of Artificial Reefs



(1)

Old tyres

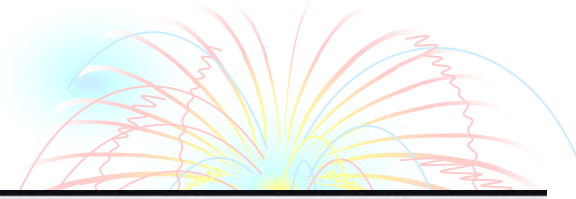


Tyres are mostly used in America, Hongkong and Taiwan

Underwater effect



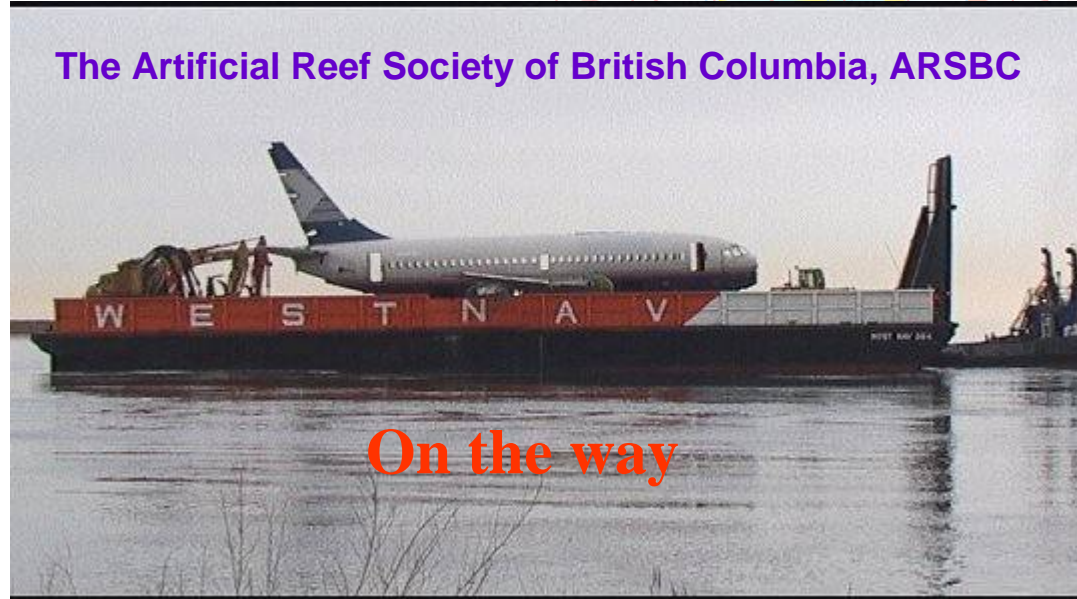
(2) Retired Airplane



Boeing 737 Airframe



The Artificial Reef Society of British Columbia, ARSBC



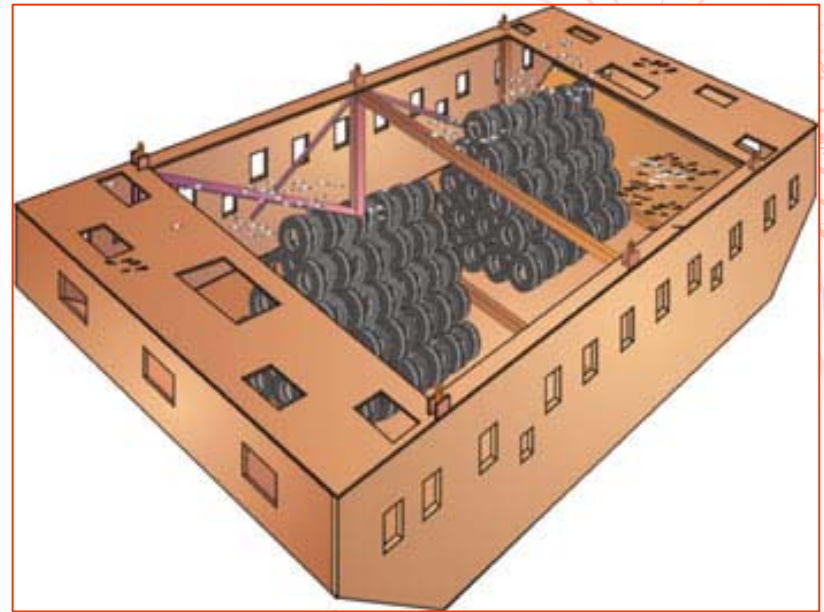
On the way

ARSBC artificial reef society used the retired airplane of Boeing 737 made in 1960's for the construction of reefs (Vancouver, Canada)

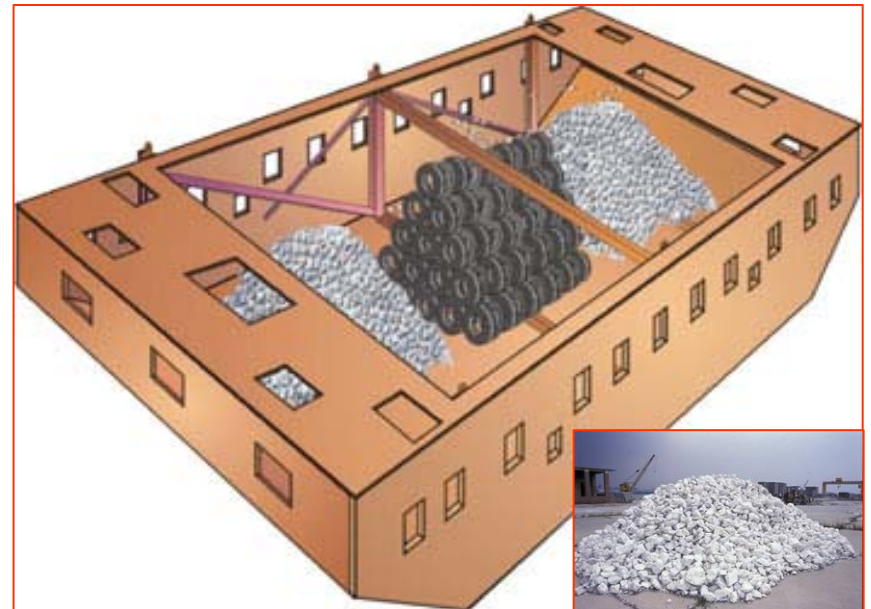
Length: 100 feet

Width of wings: 96 feet

Weight: 20 t



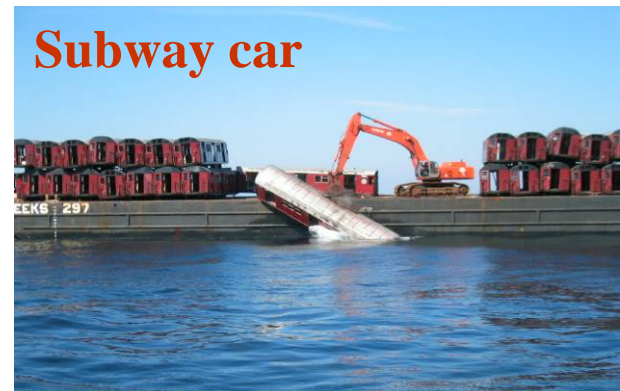
(3) Ship shaped reefs—Hongkong

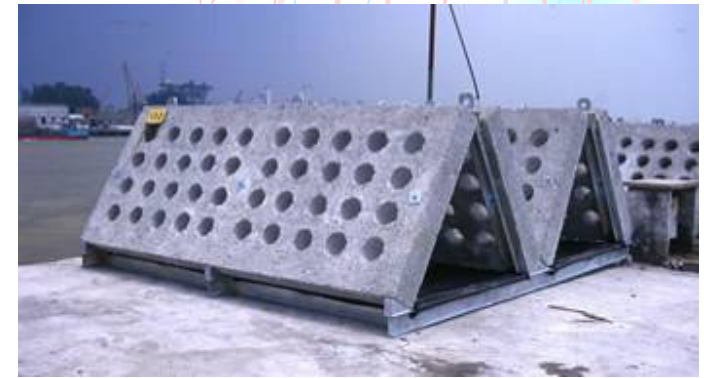


Underwater effects of the sunken ships (USA)

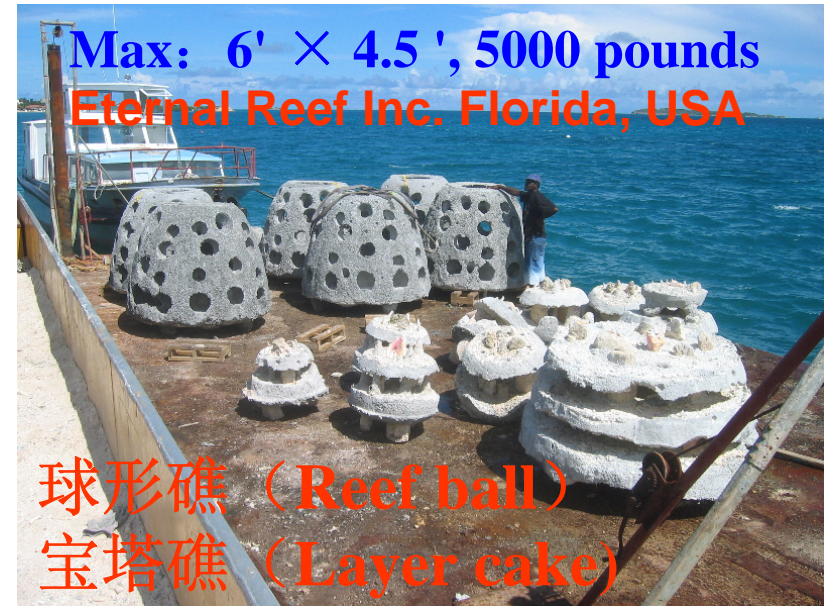


(4) Tanks and cars





(5) Various types of artificial reefs

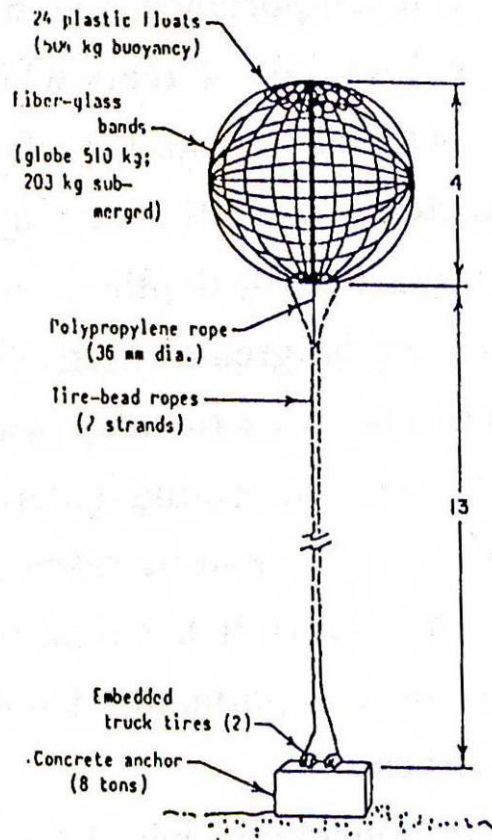


Max: 6' × 4.5', 5000 pounds
Eternal Reef Inc. Florida, USA

球形礁 (Reef ball)
宝塔礁 (Layer cake)

(6) Floating artificial reefs

Ball shaped



Umbrella shaped

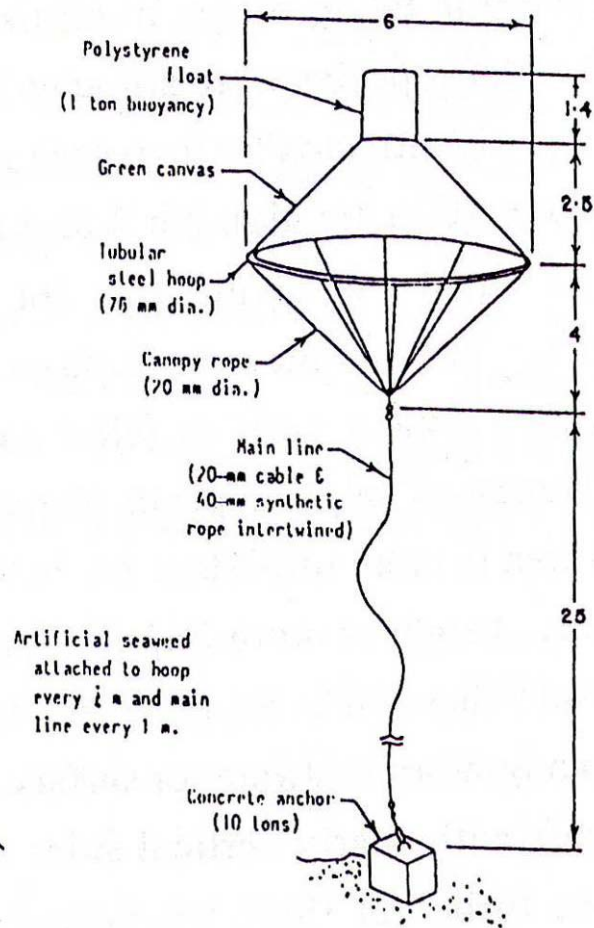
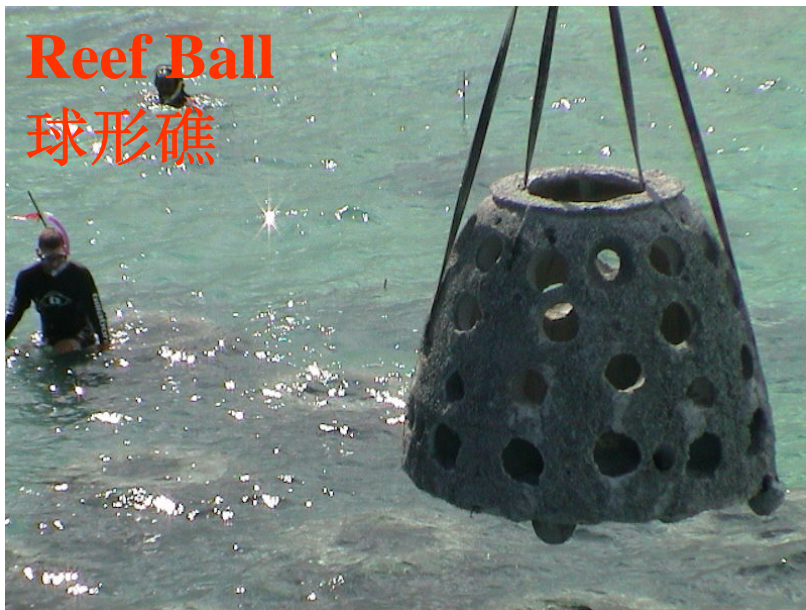


Fig 2.1.7. Floating mid-water fish attractors
(dimensions in cm.)



Eternal Reef Inc. Florida, USA

More than 500 thousand reefs have been put into the sea in 3400 projects all over the world





Performance of the artificial reefs





Except for schooling and enhancement of fish, artificial reefs can be used for the enhancement of other valuable sea animals such as sea cucumber, abalone, cuttlefish, etc.



Algae



crustacean



Other valuable species

IV Development of Artificial Reefs in Shandong Coastal Areas



Yellow Sea Fisheries Research Institute started the studies and experiment on artificial reefs in 1981 (One of the earliest institutions in China carried out the studies). About 1000 artificial reefs covering the total areas of 120 thousand m² were set up in the coastal areas of **Qingdao** and **Yantai**.

During the past five years, the **Plan for the Meliorating Fishery Resources** were carried out in Shandong Province, which greatly accelerated the development of construction and studies of artificial reef engineering. By the year of 2006, 11 artificial reef areas had been set up along the coast of Shandong Province.

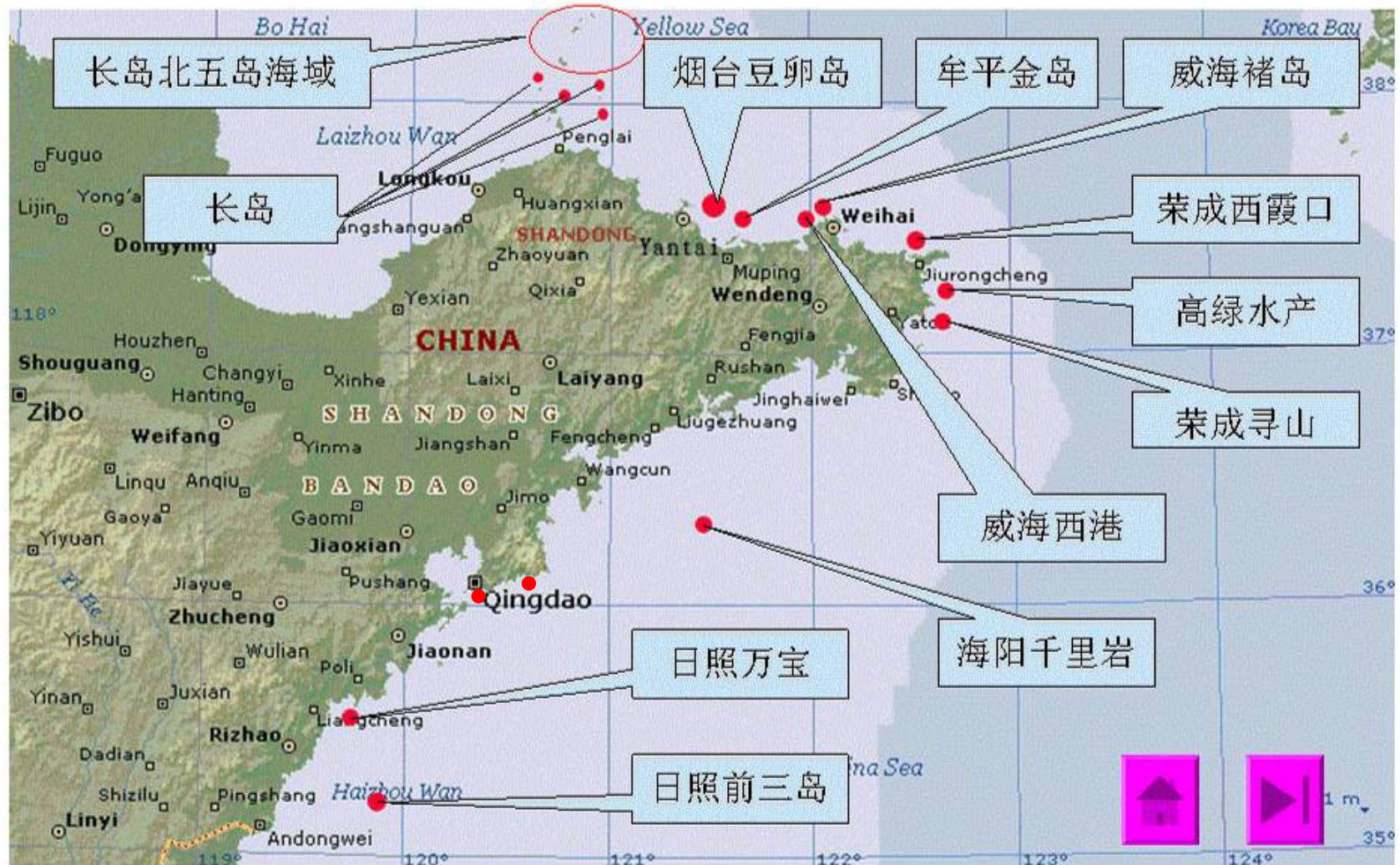
890 retired fishing ships

14.5 million m³ of stone blocks

30,543 concrete reefs

421 old cars

IV Development of Artificial Reefs in Shandong Coastal Areas



Distribution of artificial reef areas in Coast of Shandong Province

IV Development of Artificial Reefs in Shandong Coastal Areas

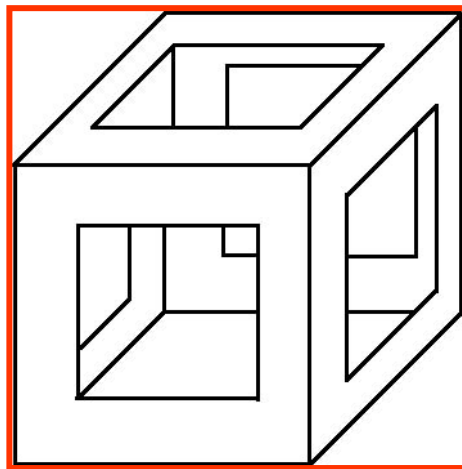


1. Related studies and experiment on reefs

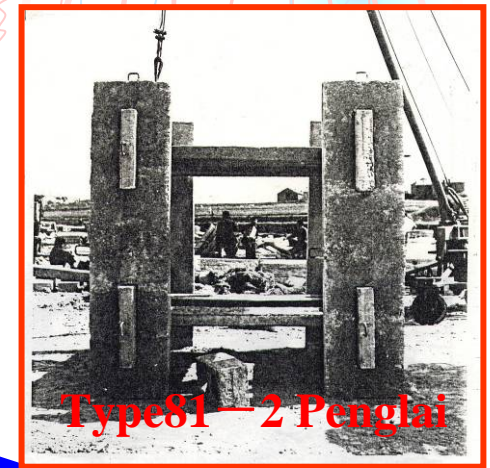
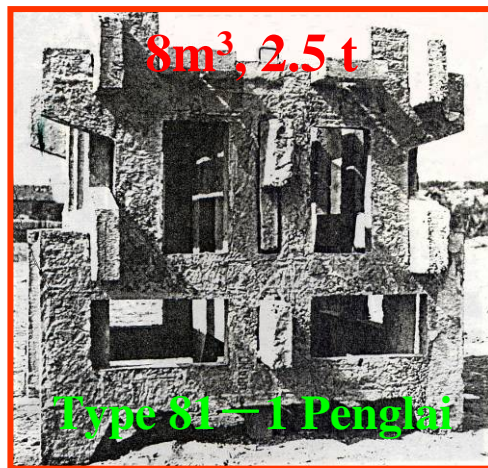
- (1) Mechanism and conditions for the formation of fishing ground after setting up artificial reefs**
- (2) Studies on current field in reef areas**
- (3) Experimental studies on setting up artificial reefs and enhancement investigation in reef areas**
- (4) Studies on composition of biological community**
- (5) Enhancement of sea cucumber (*Stichopus japonicus*) by setting up artificial reefs**
- (6) Enhancement of abalone (*Haliotis discus hannai*) by setting up artificial reefs**

IV Development of Artificial Reefs in Shandong Coastal Areas

2. Structures and layout of artificial reefs



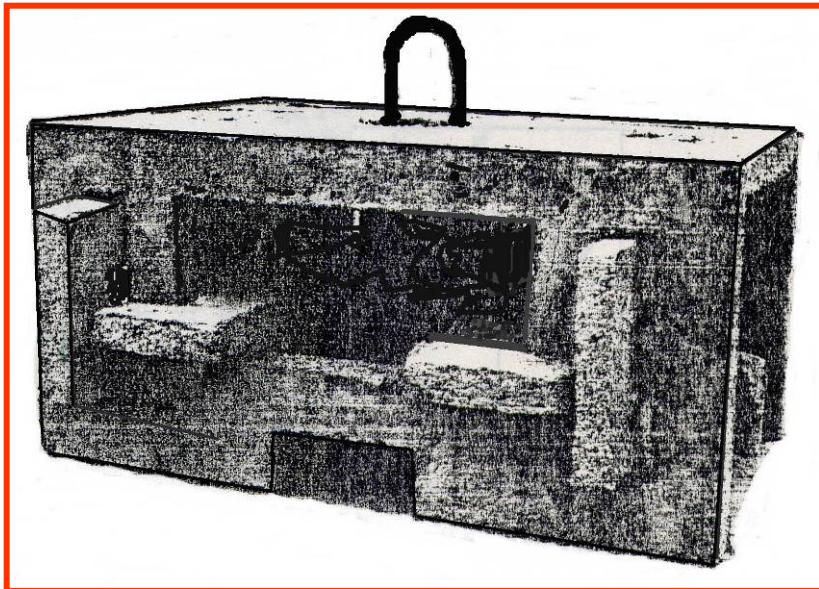
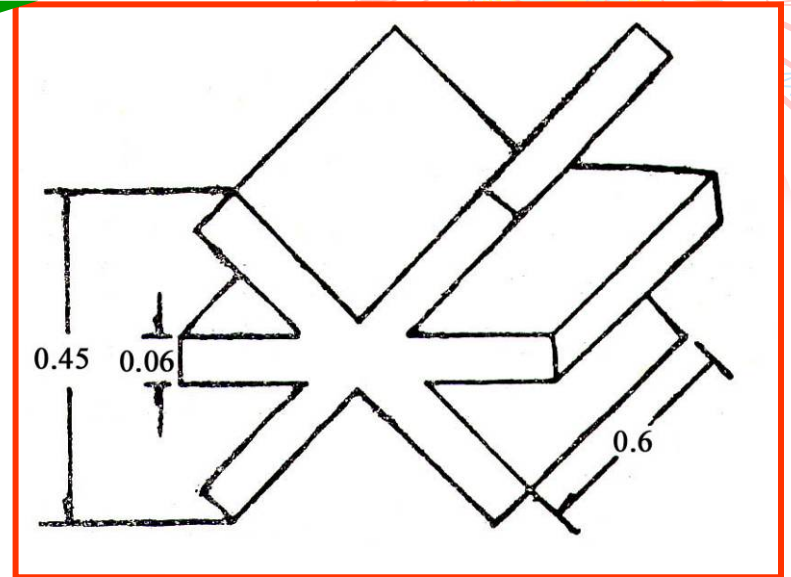
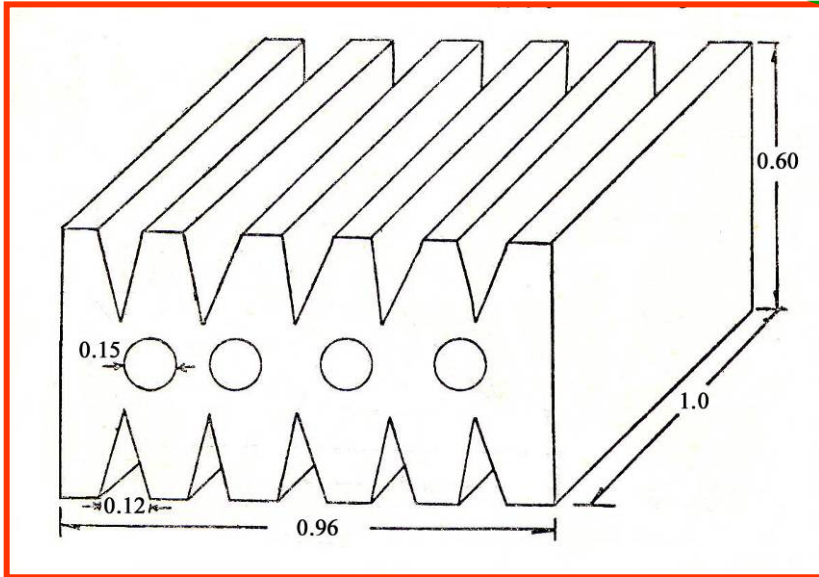
Qing 胶南 dao
鱼礁



Yan 组 装
投 放 tai



青岛胶南鲍鱼礁(Abalone reef)



烟台蓬莱海参礁
Sea cucumber reef

威海西岗鱼礁投放

Artificial reefs in Xigang, Weihai

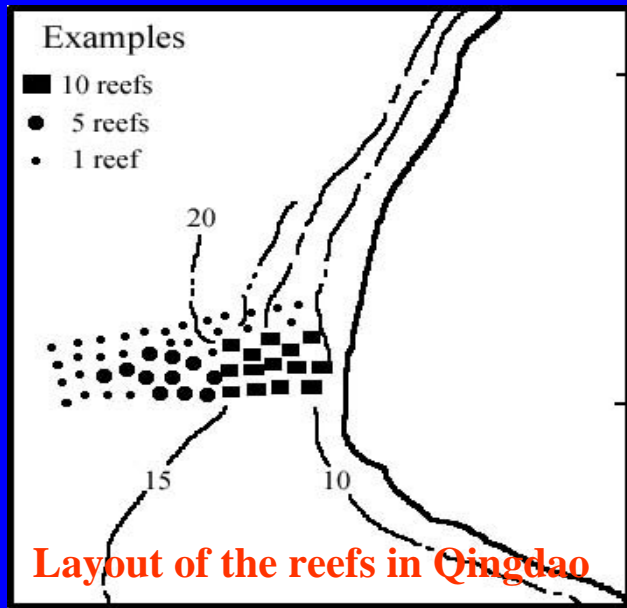


Ship shaped reef



Roof shaped reef



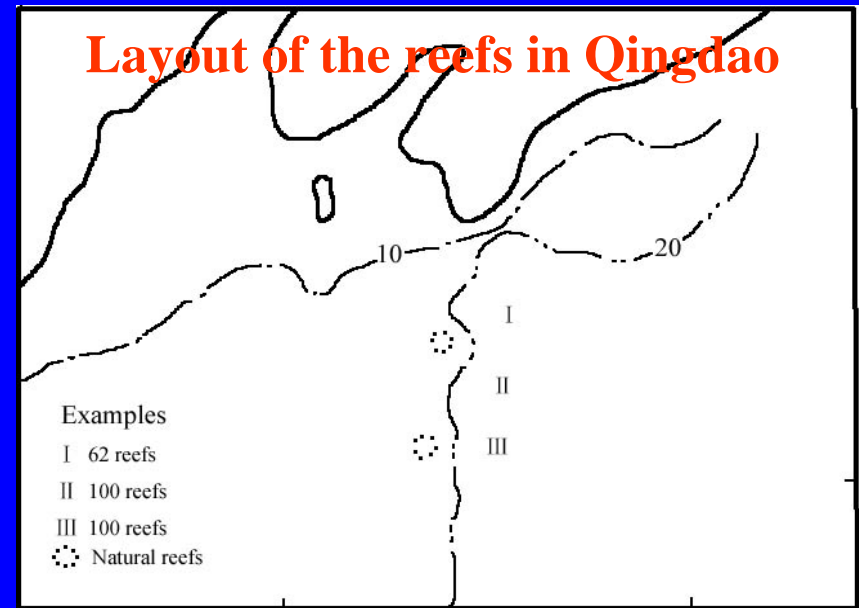


46'

N

35°

45'



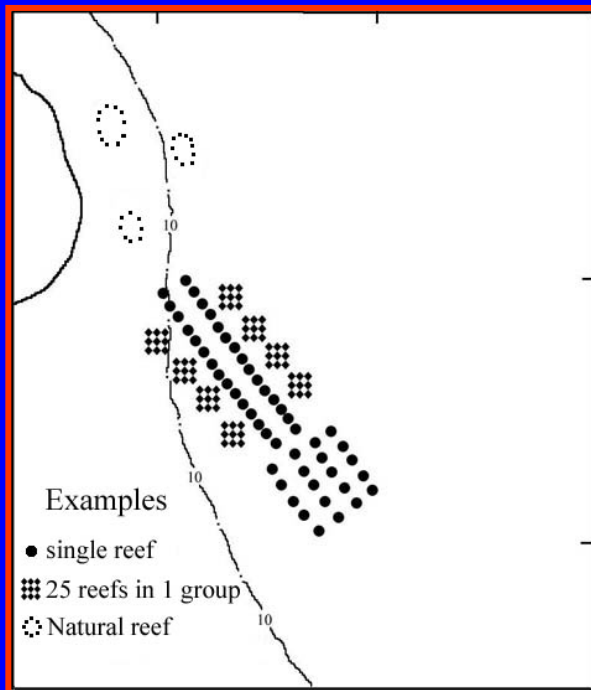
N

35°

34'

E 120° 00' 10'
E 120° 57' 58' 59'

E 119° 50' 55'



49'

N

37°

48'

Layout of the reefs in Yantai

Experiment areas and Layout of the reefs in Qingdao and Yantai

IV Development of Artificial Reefs in Shandong Coastal Areas



3. Recent progress

- 1. Investigation on the reefs set up more than 20 years ago**
- 2. Proved that some types of the artificial reefs are still in good condition after 20 years**
- 3. Investigation on biological and environmental effect in reef areas**
- 4. Established the method of numerical modeling on reefs in the current field**
- 5. Physical tests on reef hydrodynamics is in progress now**

(1) Investigation on the effect of artificial reefs set up for more than 20 years



Consulting the old fisherman

Diving



(1) Investigation on the effect of artificial reefs set up for more than 20 years



Biological and environmental sampling



(1) Investigation on the effect of artificial reefs set up for more than 20 years



Star shaped



Triangle reef



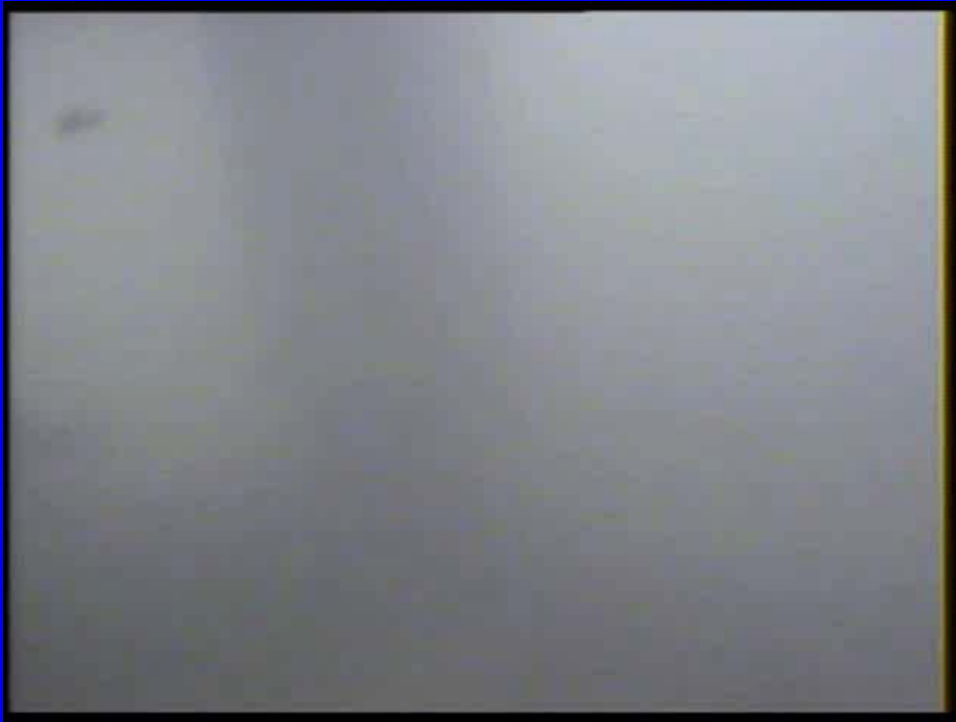
Lifting the reef up



Double M shaped

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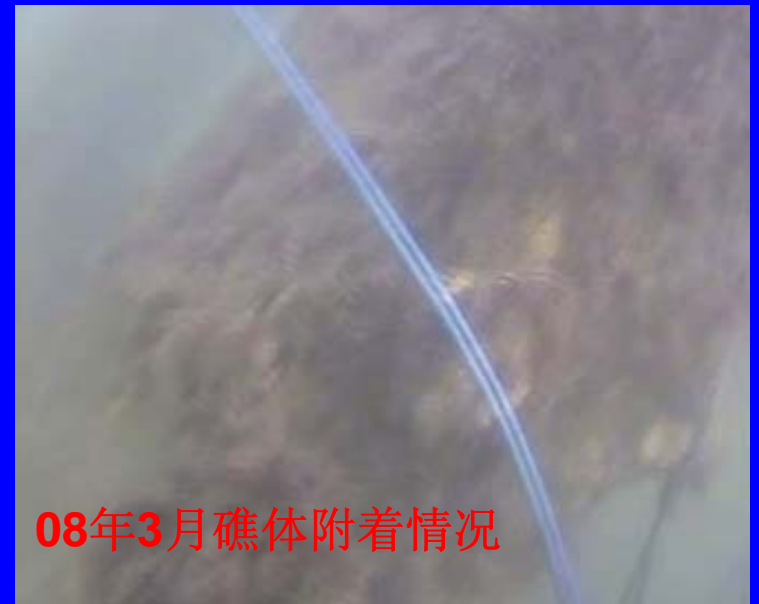
(1) Investigation on the effect of artificial reefs set up for more than 20 years



Underwater
video camera



Fish schooling
around the reefs



08年3月礁体附着情况

(1) Investigation on the effect of artificial reefs set up for more than 20 years



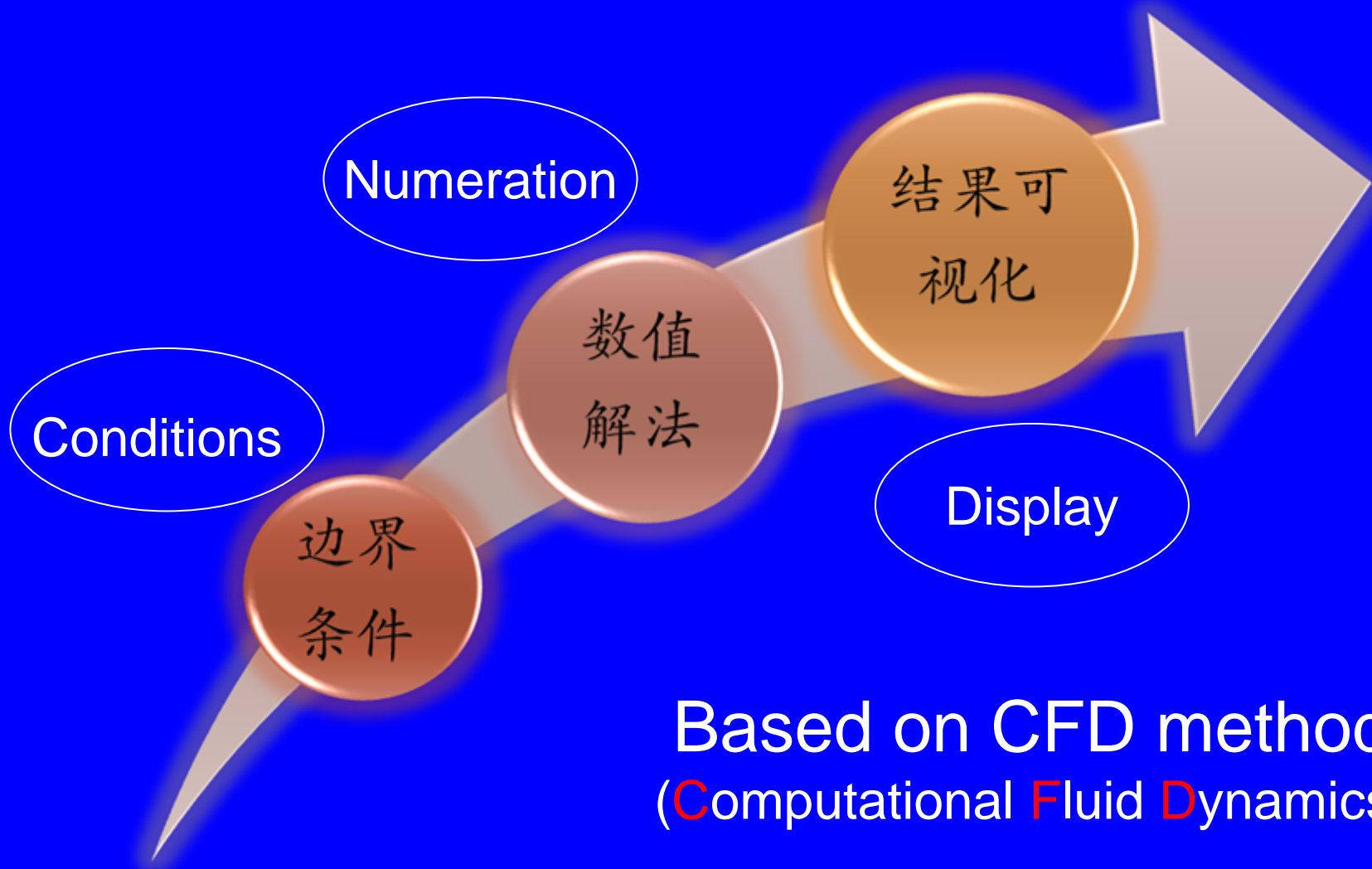
Double M shaped reef

**Underwater
video camera**

Star shaped reef



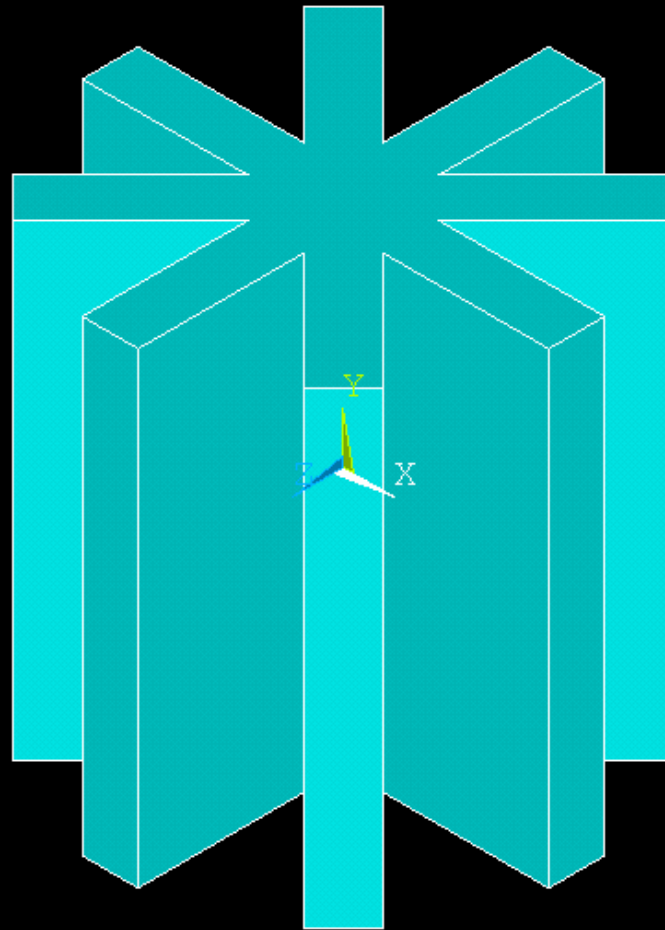
(2) Numerical modeling on artificial reefs in current field



1

VOLUMES

TYPE NUM



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SUB =1

V

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MAX=.144043



VECTOR

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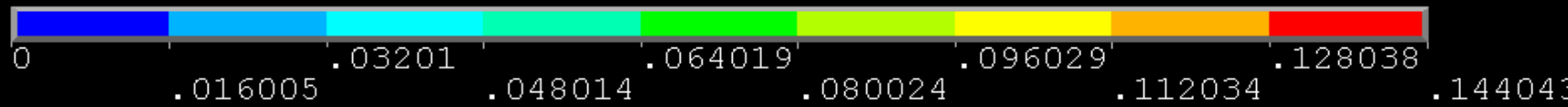
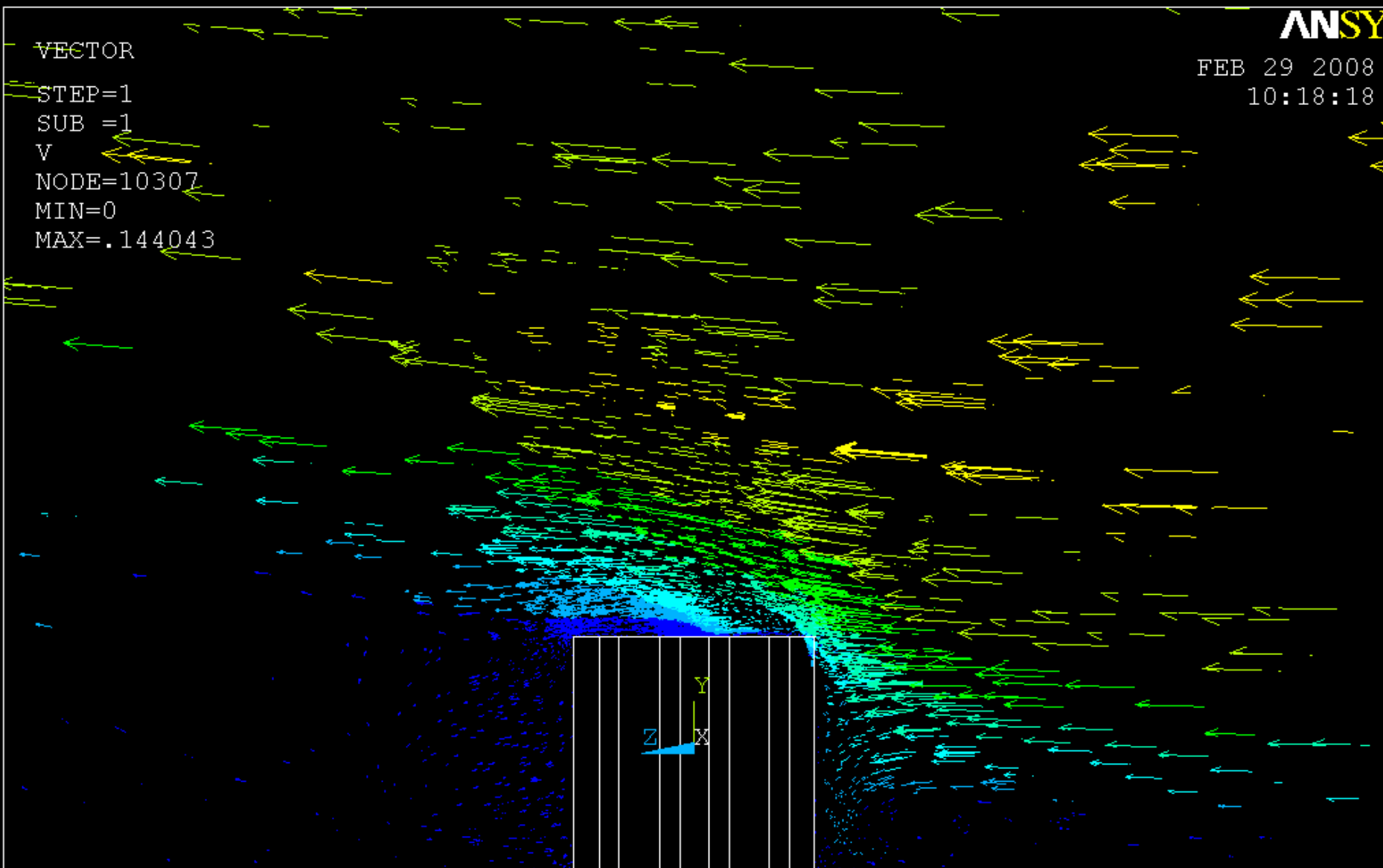
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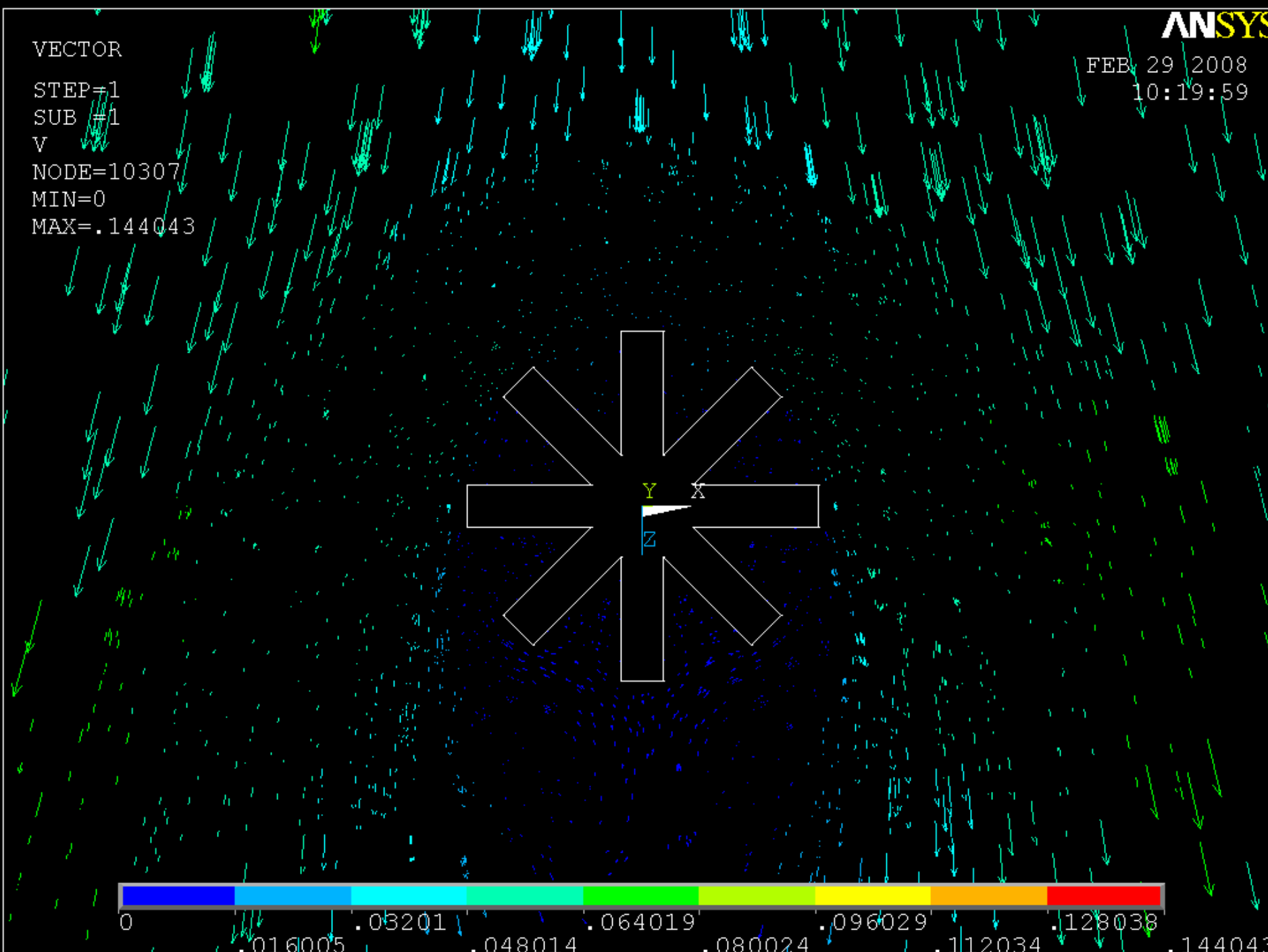
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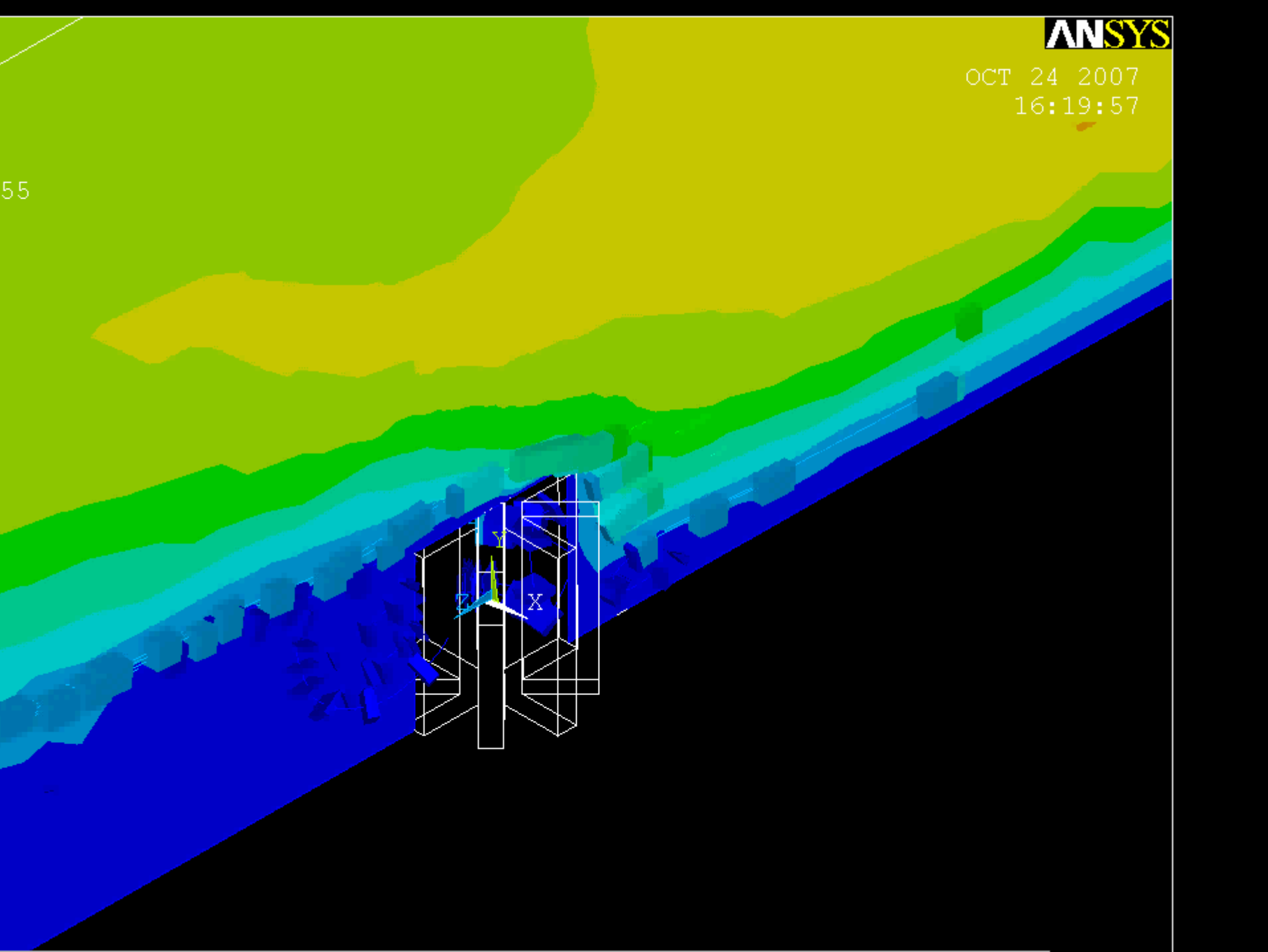
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55



《青岛早报》、《半岛都市报》的相关报道 Newspapers and Internet Report

20年前“播种”人工鱼礁今收获

水产专家在我市海域试验成功 即墨马儿岛年前建设集旅游观光渔业研究于一体的人工鱼礁群

早报讯 20多年前的,黄海水产研究所专家在灵山岛海域建设一批人工鱼礁,专家近日发现,鱼体状况基本完好,没有出现严重的沉陷与淤积现象,为我市建设人工鱼礁提供了“证据”。据悉,今年年底前,渔业部门将开工建设即墨马儿岛人工鱼礁。



人工鱼礁堪称“文物级”

黄海水产研究所所在上世纪八十年代初期我国首次开展人工鱼礁研究和建设时,在胶南灵山岛海域建设了400多个鱼礁,包括方形、三角形、扇形和M形四种形状,至今已在水下20多年。

黄海水产研究所专家将其大部分拖出水面,发现礁体状况基本完好,没有出现严重的沉陷与淤积现象,并获取了这批“文物级”鱼礁的第一手资料,其中方形的稍有破损,M形效果最好,周边聚集很多鲈鱼和鱼类,对海洋环境改善和聚集鱼群效果明显。

成为集旅游观光、渔业、海洋科普教育及海洋生态资源保护于一体的海洋生态自然保护区。据介绍,计划在马儿岛海域建设的6平方公里的人工鱼礁,由50个小礁群组成,总数量640个。

(许芳 关长坤 摄影报道)

新闻背景

人工鱼礁神奇玄妙

马儿岛海域大批投放

20多年前的“古雷”鱼礁在一定程度上证明青岛海域适合建设人工鱼礁。记者从市海洋与渔业局得知,我市首个人工鱼礁建设项目——即墨马儿岛计划将于今年年底前开工建设。马儿岛海域将建设6平方公里的人工鱼礁,项目建成后将会

人工鱼礁,一般是指水深在100米以内的沿海海底设置的、具有一定形状的混凝土结构体或类似物体。这种人工鱼礁,用光能修礁人,有利于生物繁殖生长,能促使鱼类聚集和增殖鱼类资源。

关于人工鱼礁集鱼的原理,目前还有争议。一种理论认为,人工鱼礁能水流向上运动,形成上升流,把富含丰富的海水带来,吸引鱼群前来觅食;另一种理论认为,人工鱼礁能产生阴影,许多鱼类喜欢阴影,故意游过来;还有一种理论认为,人工鱼礁能给鱼儿提供躲避风浪和天敌的藏身之地,因此它们喜欢在这里生活。

专家从海中吊起“古雷”鱼礁

经过一年多的寻找,今年10月,截至昨日已经发现并标记100余个。

开车撞伤人发酒疯被拘

早报讯 4日晚11时,一男子酒后驾驶车辆在沙子口路段将一名过路妇女撞伤,被送往医院救治。交警赶到现场处理,发现男子酒气冲天,指带其抽血化验,并给受伤妇女做检查。不料男子不仅拒绝抽血,还无理要求行人也要抽血。交警等男子向交警大队方向寻求处理,男子还在车上耍赖交钱,并将交警左眼打伤。昨日,莱阳被崂山警方刑事拘留。(通讯员 周晓波)

刷屋顶踩空四米高摔下

早报讯 昨天下午4时许,在平安路附近一处二层小楼内,一名装修工人在粉刷屋顶时,不慎从一个4米高的架子上摔下,被送往海慈医院急救。记者在急诊室见到,受伤的居民的头部已经用纱布包裹,胳膊处用绷带固定包扎,胳膊因骨折有很多血。我则在头顶部受重,身上到处都疼。”据某建筑公司对记者说,紧急送



昨夜逮着“01”号醉酒司机

昨晚,市南交警大队出动民警在云霄路与江西路交界处,查获了市南酒后驾车专项整治行动以来的首个“01”号醉酒司机。

昨晚,市南交警大队出动民警在云霄路与江西路交界处,查获了市南酒后驾车专项整治行动以来的首个“01”号醉酒司机。

但是每次都是轻轻的吹一口气,在第11遍时,司机深深吸了一口气,酒精测试仪显示是113mg/100ml,属于醉酒驾驶机动车。根据规定,交警将带他去法院抽血化验。

陈勇 张毅民 于昕 摄影报道

崂山区商品房价格连续走高

早报讯 昨日记者从崂山区政府获悉,前三季度崂山区商品房平均销售价格达8694元/平方米,同比增长9.8%,平均销售价格比上个月提高163元/平方米。据了解,崂山区商品房销售持续火热,商品房平均销售价格走高。今年前三季度,崂山区商品房施工面积604.56万平方米,同比增长49.6%。(许芳)

市南区118处危漏房即将修缮

早报讯 在市政公用维修基金修缮20处问题严重的危漏房后,记者昨天从市南区住建局了解到,又有118处危漏房将进入修缮范围,总计4000户将从中受益。

据介绍,这批即将修缮的漏雨房屋有118处,主要在团岛二路、安徽路、黄岛路、河南路、湖北路、伏龙路、莱阳二路等路段附近,计划工期一个月。市南房产处也将继续

半岛都市报 新闻
news.bandao.cn

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半岛都市报

新闻检索:

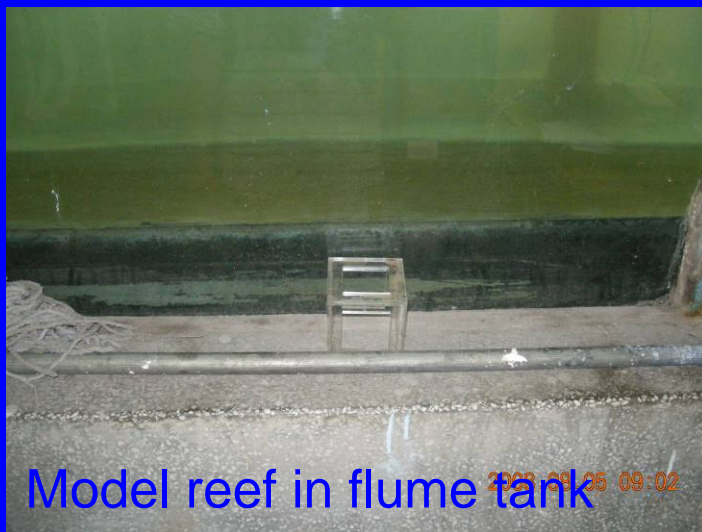
胶南发现“文物级”人工鱼礁 “沉睡”20年基本完好

2007-11-06 13:07 来源:半岛网-半岛都市报 【大 中 小】网友评论 进入论坛

半岛都市报
www.bandao.cn

专家们正在打捞人工鱼礁

(3) Physical test on reef hydrodynamics



The test is in progress now, result may be presented next!

Marine Ranching



Thank You!