

SEA AND COASTAL PROTECTION WITH REEF BALL

Submerged breakwaters for coastal protection and reconstruction, for restocking of fish, estuary restoration, mangrove planting.

Design, construction and implementation of ecofriendly technology.



REEF BALL ITALIA

Reef Ball Foundation is a 501 (c) 3, publicity supported non-profit and international environmental NGO working to rehabilitate marine habitats, ocean reefs ecosystems as well as preventing costal erosion and enhancing fish population, using Reef Ball technology.

Reef Ball Foundation has conducted over 4,000 projects in 60 Countries and deployed over ½ million Reef Balls. Reef Ball Italia is the authorised Reef Ball contractor trained to the highest standards in the deployment of Reef Balls.

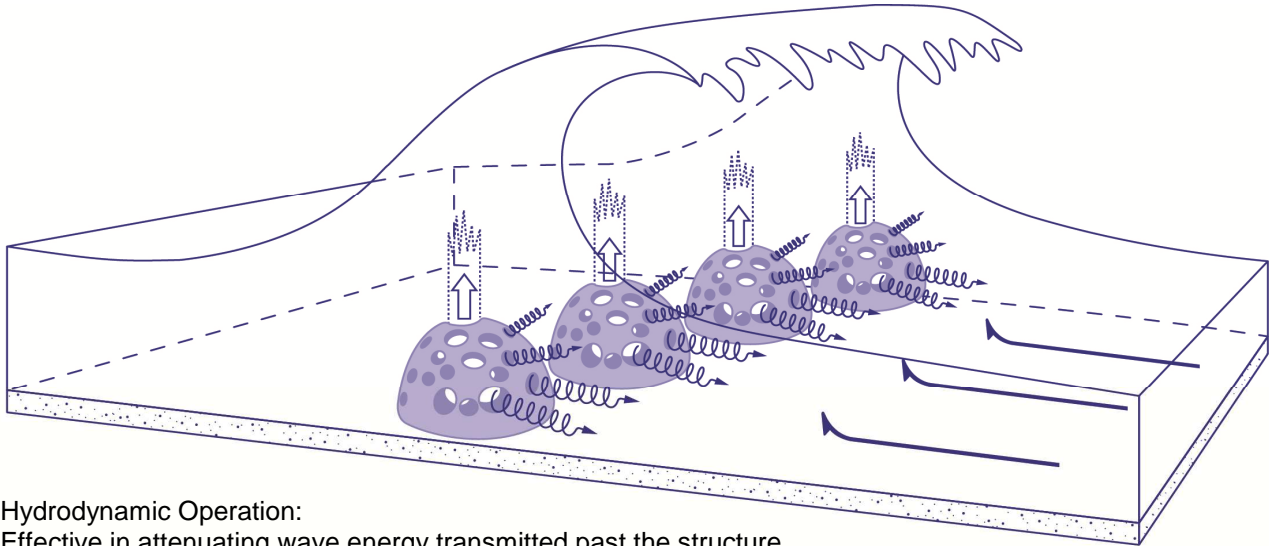
Reef Balls are round shaped units, with several standard mould sizes, made out of a 'sea friendly' concrete with pH similar to natural sea water's 8.3 (regular concrete which has a surface pH as high as 12) stimulating the settlement and growth of many species of marine life including larval corals, giving Reef Balls a lifespan of 500+ years.

Reef Balls are squeezed against the moulds during casting making the inside and outside of the holes smaller than the interior cavity thereby creating a whirlpool effect. Reef Balls are made without iron frames reducing cement degradation in sea water.

ADVANCES IN DESIGN AND FUNCTIONALITY

Reef Balls used as submerged breakwater are a high quality alternative to traditional artificial breakwaters, bringing significant advantages such as:

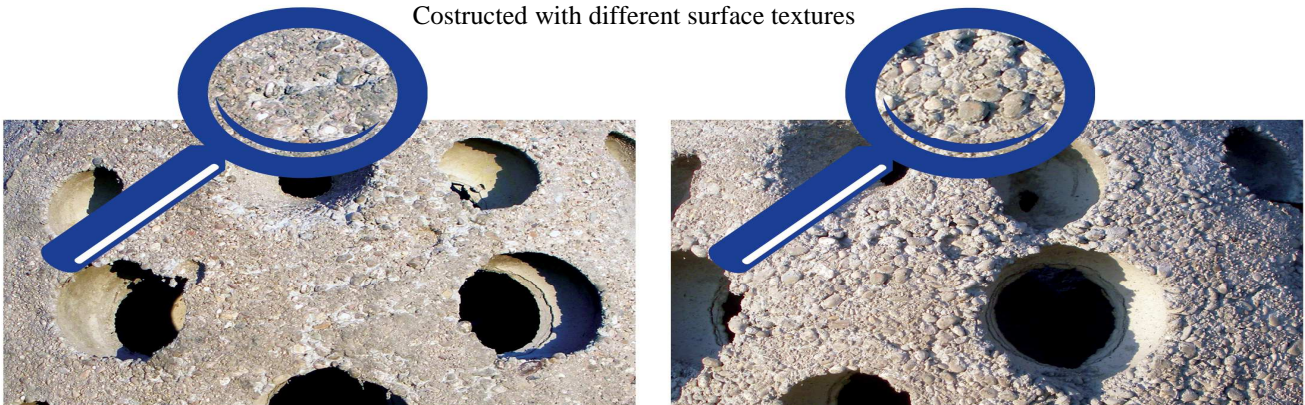
Hydrodynamic Operation – Reef Balls are used as submerged breakwater to protect the coast from erosion. The effectiveness of a breakwater in attenuating wave energy can be measured by the amount of wave energy transmitted past the structure, through the holes of the Reef Ball. The greater the wave transmission coefficient, the lower the wave attenuation.



Hydrodynamic Operation:
Effective in attenuating wave energy transmitted past the structure

Environmentally friendly – made out of concrete that has pH similar to natural sea water, allowing the settlement and growth of many species of marine life.

Constructed with different surface textures



Permeability – Permeability prevents the "ponding" effect that can occur behind a breakwater, where the overtopping of waves can create an increased water level behind the breakwater, causing an accelerated return flow that can scour around the ends of the breakwater and wash sand out from the landward

Economic benefits - lower percentage of stone material used than the average rock breakwater, lower quarry and transport costs by building the structures on site.

Stability and Longevity - Reef Balls are designed so that over half of the weight is at the base near the sea floor. All sizes of Reef Balls have shown not to move during heavy tropical storms. Reef Balls are stable because the opening at the top of the unit breaks up the lifting force of the hydrofoil effect common to dome shapes. This feature creates miniature vortexes which further reduce lifting forces and bring rich nutrients to sea life on the reef. In addition, their wide base and weight, the Reef balls can also be used to prevent illegal fish trolling.

Natural Beach Nourishment – Reef Balls promote natural beach nourishment, shoreline stabilization, as well as maintaining artificial beach nourishment.

Opportunity – Reef Balls encourage the development of ecotourism, through snorkelling and diving.

The basic premise of Reef Ball submerged breakwaters is to mimic natural reef systems and their ability to attenuate waves so that beach erosion is managed through a natural process. The exact amount of attenuation is usually engineered for each project and is controlled by depth, wave climate, number of rows of Reef Balls, spacing of Reef Balls, etc. Furthermore, using Reef Balls as submerged breakwater will reduce the use of stone material, minimising additional damage to the environment.

Natural Beach Nourishment:

Reef Balls promote natural beach nourishment, shoreline stabilization, as well as maintaining artificial beach nourishment



Marriot Beach Resort, 2002



Marriot Beach Resort, 2005



Marriot Beach Resort, 2007

Reef Balls properly aggregated, allow the creation of “alive” submerged breakwaters for coastal erosion protection. One of the key characteristics of these units is the integration of the structure in the marine ecosystem, encouraging the colonisation of different species. This may be facilitated by implanting, on the side of the Reef Balls corals, sponges and other filter feeders such as mussels and oysters. This encourages other activities such as fishing and snorkelling, increasing the attractiveness of the surrounding area.

The submersion and the permeability of the structures enable good water circulation, low impact on the environment as the level of the crest located below the sea level and settlement of fouling and non-fouling community. The side holes and the central cavity of the Reef ball create miniature vortexes which further reduce lifting forces and bring rich nutrients to sea life on the reef and possible shelter from predators.

The benefits related to the implementation of a Reef Ball submerged breakwater, reside in affordable intervention, easy implementation and installation. Reef Balls as submerged breakwater are considered with increasing interest in the development of coastal protection.

Fish Enhancement– The unique Dome shape with side holes wider near the centre of the walls and narrower near the unit's surface creates miniature vortexes which further reduce lifting forces and bring rich nutrients to sea life on the reef.



Any structure in the sea can be defined as an “artificial reef” while an area with sandy bottom in which artificial Reef Balls are placed, can be defined as an “oasis of restocking”. This is achieved through the active transformation of the natural environment.

A Reef Ball artificial reef is a highly engineered piece of work, created to promote marine biodiversity. They are built according to precise models that increase the ability to provide shelter and enhance the settlement of marine life.

Such objective has been achieved by adopting a geometric shape that maximises the surface in contact with water. The surface of Reef Ball 'goliath' type measures 21 sqm and can be made in a variety of surface textures that enhance the settlement of marine life.

Longevity – the concrete used to make the Reef Ball is high strength and abrasion resistance. Reef Balls are made without iron frames reducing cement degradation in sea water giving a lifespan of 500+ years.



In 1993, the first Reef Balls were placed to rehabilitate a coral reef, for fish enhancement and grow recreational activities such as snorkelling and diving. Subsequently, in 1999 Reef Balls were used as submerged breakwaters to protect the beach from erosion at the 'Gran Dominicus Resort', in the Dominican Republic. Our worldwide Reef Balls projects have clearly demonstrated the effectiveness, durability and stability of such erosion control application, maintaining their functionality following direct hits by hurricanes.

Therefore, we believe that instead of using breakwater rocks which can have a negative impact, it is more beneficial to adopt Reef Balls for submerged breakwaters as they will help substantially reduce environmental damage in beach "re-nourishment" projects while becoming a vibrant reef ecosystem.

FIRST



Beach Gran Dominicus Resort 1999

AFTER



Beach 2001



Pose Reef Ball lagoon Venice 2012



Reef Ball 2013

Project Indonesia



Membangun **Surga Bawah Laut** Masa Depan



Pelestarian Terumbu Karang

2004



2006



2008



2010



Project Antigua





Style Standard

Resulting from years of research the set up shown is used in most of its projects with ease of installation, longevity and environmentally friendly.

Materials:

Made out of concrete that has pH similar to natural sea water, allowing the settlement and growth of many species of marine life. The concrete used to make the Reef Ball is high strength and abrasion resistance. Reef Balls are made without iron frames reducing cement degradation in sea water giving a lifespan of 500+.



Techniques for the rehabilitation of water quality

Also used to facilitate depuration of water processes in closed or semi enclosed water bodies such as lakes, channels and lagoons.

Reef ball can be made by using microorganisms which are activated both in the concrete and in the ceramics of the artificial corals.

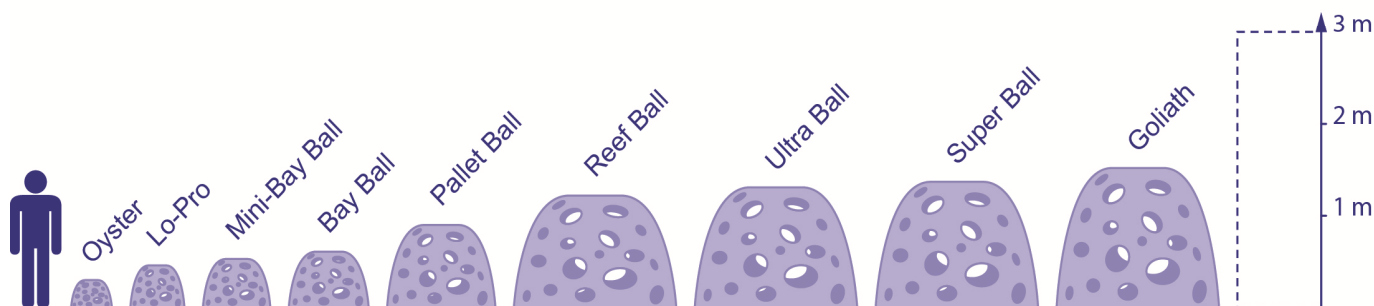


Main objectives:

Rehabilitation of water quality by enhancing and increasing water circulation and bio-filtration.

Eliminating the formation of bad odours by restoring the environmental balance naturally and reestablishing pre-existing conditions where possible.

	Diametro	Altezza	Peso	Volume cls	N° fori
Goliath Booster Ring	2,00 m	1,00 m	1816-2727 kg	1,19 m ³	15-25
Goliath	1,83 m	1,52 m	1800-2700 kg	1,00 m ³	25-40
Super Ball	1,83 m	1,37 m	1800-2700 kg	1,00 m ³	22-34
Ultra Ball	1,83 m	1,31 m	1600-2000 kg	0,70 m ³	22-34
Reef Ball	1,83 m	1,22 m	1350-1900 kg	0,60 m ³	22-34
Pallet Ball	1,22 m	0,90 m	700-1000 kg	0,25 m ³	17-24
Bay Ball	0,90 m	0,61 m	170-340 kg	0,08 m ³	11-16
Mini-Bay Ball	0,76 m	0,53 m	70-90 kg		8-12
Lo-Pro	0,61 m	0,46 m	35-60 kg		6-10
Oyster	0,46 m	0,30 m	15-20 kg		6-8



Available in sizes ranging from 30 cm to 1,52 metres. Other sizes available on request.

Reef Ball deployed in rows allow the construction of submerged breakwaters. Several studies about the hydrodynamic functionality have been made. Pictures included of studies carried out by Lee E. Harris of the US Army Corp of Engineers and Florida Tech as well as test made by Università Federico II.

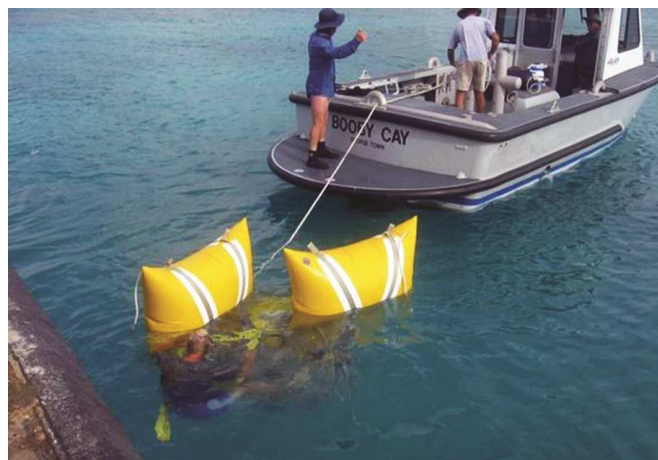


Reef Ball are built using a Fiberglass cast placed on a set of polyform bladders.

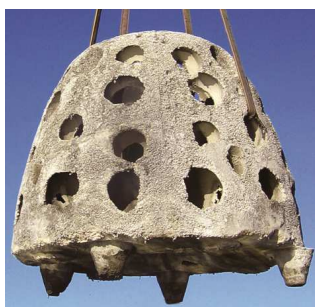


Deployment:

The structure of the modules makes installation fast and easy. Reef Balls can be lifted from a barge using straps, chains or by pulling the Reef Balls from the shore, using flotation polyform bladders.



Anchoring Methods: Anchoring Cones



Anchoring Spikes Rebar



Battered Anchoring Pilings Anchoring with Battered Fiberglass



Text:
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