

# *Muroto Deep Seawater Guide Book*

世界ジオパーク認定



# Muroto Deep Seawater is Awesome!



## What is deep seawater?

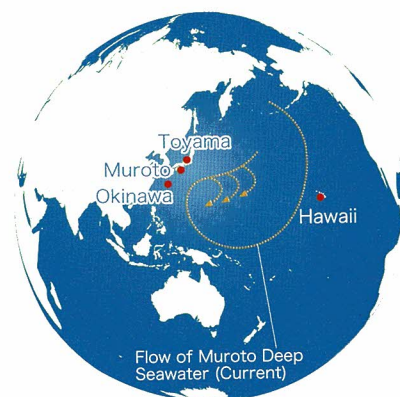
Deep Seawater has recently been receiving close attention due to its unique properties. There are 15 deep seawater pumping facilities throughout Japan and deep seawater is used in a wide range of products from foods to daily commodities.

Deep seawater is a generic name for seawater from a depth of more than 200m under the sea. There are several great currents in the world, one of which is the Oceanic Great Circulation that makes a slow circulation from the Atlantic Ocean, through the Indian Ocean, to the Pacific Ocean taking about 2,000 years.

Muroto deep seawater originates from the Sea of Okhotsk where cold water sinks deep under the sea. The flow travels southward in the Pacific Ocean at a depth of about 1,000m, changes its direction clockwise after passing west of the Hawaii Islands, then changing direction again near the equator, where it turns towards Japan and makes an approach close to Cape Muroto.

Why can deep seawater be pumped up off Cape Muroto? The answer is related to the geographic properties peculiar to Muroto, which is associated with the 'Muroto UNESCO Global Geopark.'

There is almost no continental shelf off Cape Muroto and the seabed plummets sharply near the land, making the sea current climb up along the steep slope. Thanks to this geographic feature, deep seawater that normally occurs 1,000m below sea level can be pumped up from about 300 m under the sea at Muroto.



# The Awesome Points of Deep Seawater

## ◎It is rich in minerals and nutrients.

Deep seawater lies in the abyssal zone, which is barely touched by the light of the sun. In this environment, phytoplankton is less active, so that the nutrients on which it would normally feed, such as nitrogen, phosphorous, hydrated silica and other non-organic salts (minerals) remain abundant.

## ◎It is pure and clean.

As deep seawater flows deep under the sea, far from land, it contains very little in the way of organic substances, pathogenic microorganisms or environmental pollutants.

## ◎It is stable at low temperature.

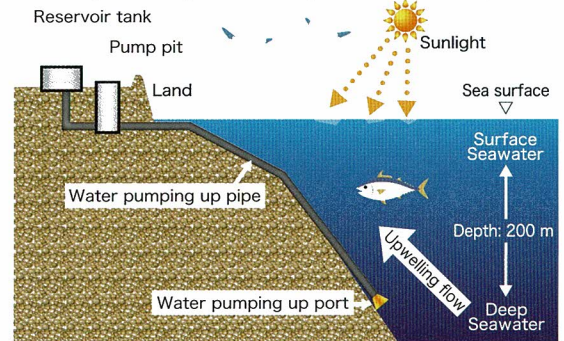
As it flows under the cold abyssal zone, deep seawater is, of course, colder than surface water. The water temperature is stable at about 9 °C throughout the year (That of Muroto deep seawater is 10 to 12°C). The deep seawater off Cape Muroto is highly matured because it is exposed to high pressure deep under the sea for years.

### Comparison of Data of Deep Seawater and Surface Seawater

Item/Unit	Surface Seawater	Deep Seawater (320m)
Water temperature / °C	16.1~24.9	8.1~9.8
pH	8.1~8.3	7.8~7.9
Salt content / ‰	33.7~34.8	34.3~34.4
Dissolved Oxygen / ppm	6.4~9.5	4.1~4.8
NO <sub>3</sub> -N(nitrate nitrogen) / μM	0.0~5.4	12.1~26.0
PO <sub>4</sub> -P(phosphate-phosphorous) / μM	0.0~0.5	1.1~2.0
SiO <sub>2</sub> -Si(silicate-silicon) / μM	1.6~10.1	33.9~56.8
Viable bacteria count / CFU / ml	10 <sup>3</sup> ~10 <sup>4</sup>	10 <sup>2</sup>

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### Conceptual diagram of deep Seawater taking



# Muroto Deep Seawater is Especially Awesome!

## ◎Japan's First Water Pumping Facility

It was in 1989 when Kochi Prefectural Deep Seawater Laboratory was established as the third of its kind in the world. It was, of course, the first facility in Japan. Following its establishment, Muroto Deep Seawater Aqua Farm was set up with the aims of making deep seawater more popular and establishing a deep seawater business.

### Kochi Prefectural Deep Seawater Laboratory

#### Deep seawater pumping equipment

	No.1	No.2
Year of introduction:	1989	1994
Pumping depth:	320m	344m
Pipe ID:	125mm	125mm
Material:	Steel wire armored hard polyethylene	Steel wire armored hard polyethylene
Total length:	2,650m	2,650m
Power consumption:	7.5kw	7.5kw
Pumping volume per day	460kl/day	460kl/day

#### Surface seawater pumping unit

Year of introduction:	1994
Pumping depth:	0.5m
Pipe material	Vinyl chloride
Power consumption	7.5kw×2 units
Pumping volume per day:	920kl/day

### Muroto Deep Seawater Aqua Farm

#### Deep seawater pumping equipment

Year of introduction:	2000
Pumping depth:	374m
Pipe ID:	270mm
Material:	Steel wire armored hard polyethylene
Total length:	3,125m
Power consumption:	30kW
Pumping volume per day:	4,000kl/day

## ◎The sea in Muroto is especially clean!

As there are no big cities or industrial complexes located around Cape Muroto, Muroto deep seawater contains very few environmental pollutants. Moreover, as there are no big rivers in the area, the sea around Cape Muroto remains free of mud washed downstream when a typhoon hits the area, and therefore clean seawater can always be collected.



### Kochi Prefectural Deep Seawater Laboratory

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### Muroto Deep Seawater Aqua Farm

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 Open: 9:00 - 17:00 Closed on: Sundays and national holidays