

# Science for Ocean Actions

Sustainable management of biological resources:  
the importance of knowledge for finding regional solutions to global challenges

# Kelp aquaculture

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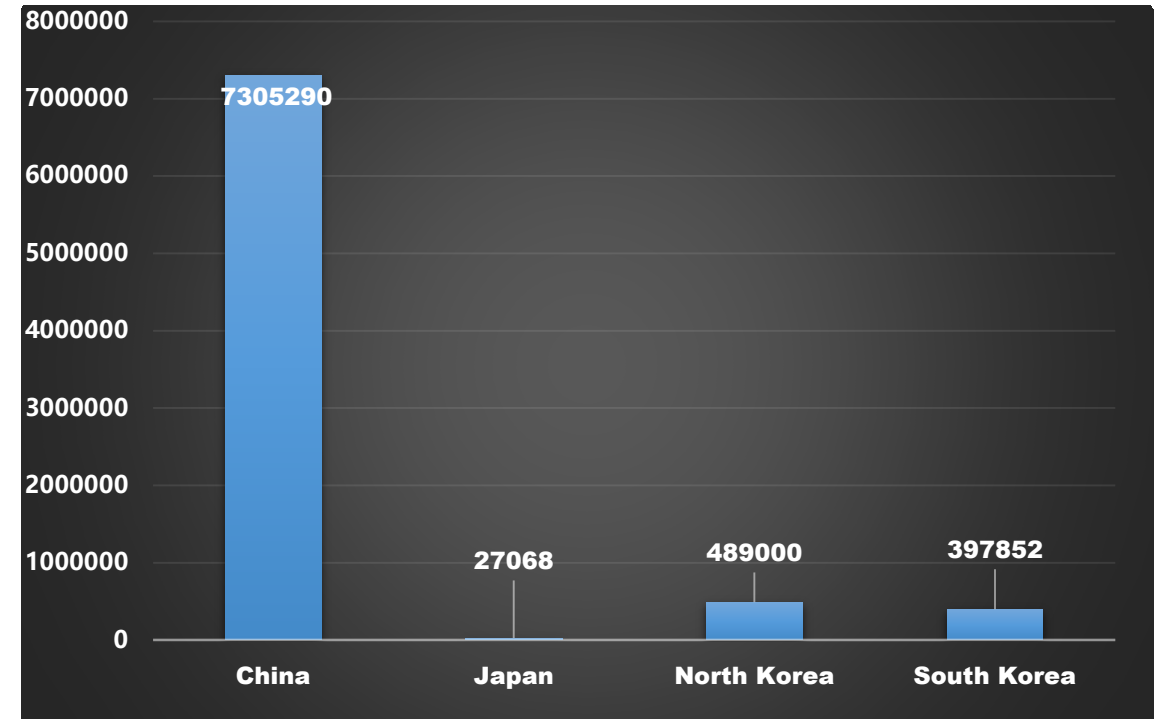
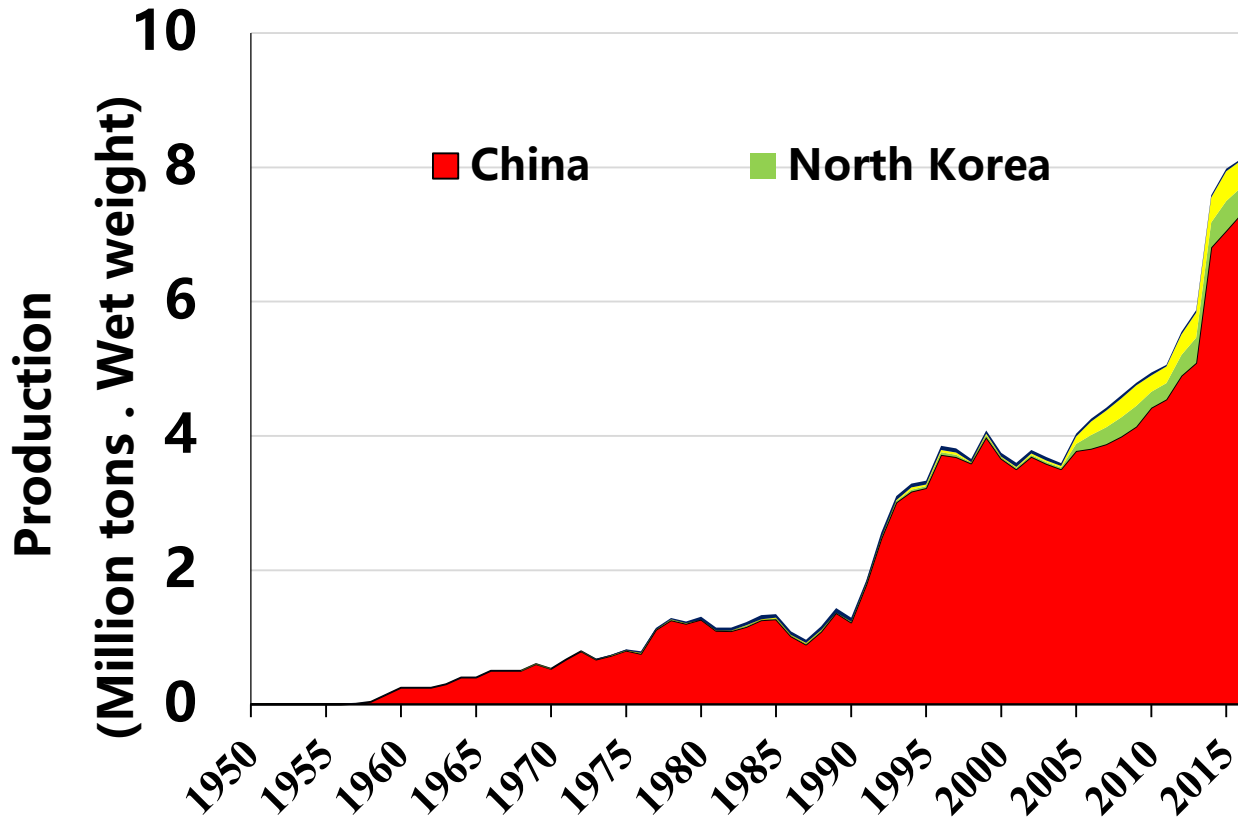
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# Development of Kelp Aquaculture in the world

Data source: <http://www.FAO.org/fishery/>



Kelp aquaculture production in the mainly kelp aquaculture countries in 2016 (tons. Wet)

- **Aquacultur of Kelp has Mainly developed in Japan, Korea Peninsula and China.**
- **Some European Countries such as Norway, Germany and Ireland... and North America started the kelp aquaculture in Pilot scale recent years.**

# Main usages of kelp

## ( 1 ) Food for human

Variety of different types of healthy food



# The nutrition in kelp food:

## Health food

- **low in calories, medium in protein, high in minerals;**
- Rich in carotene, thiamine, riboflavin, niacin and other vitamins.
- helping digestion, preventing obesity and constipation.

## Main contents in kelp

<b>Protein</b>	8g/100g kelp
<b>Ca</b>	117mg/100g kelp
<b>Fe</b>	150mg/100g kelp
<b>Iodine</b>	24mg/100g kelp
<b>Carbohydrate</b>	56g/100g kelp

The rich content of Calcium, Fe and Iodine in kelp is very important for human health

# Main usages of kelp ( 2 ) Chemical products



Seaweed fibre



Sodium alginate

## Kelp Chemical products

Sodium alginate

Seaweed iodine

Mannitol

Sorbitol

Propanediol alginate

Alginate polysaccharide

Alginate potassium

Alginate calcium

Alginate ammonium

Dental gum

Alginate fiber

Organic fertilizers

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# Kelp aquaculture play important roles in coastal environment remediation

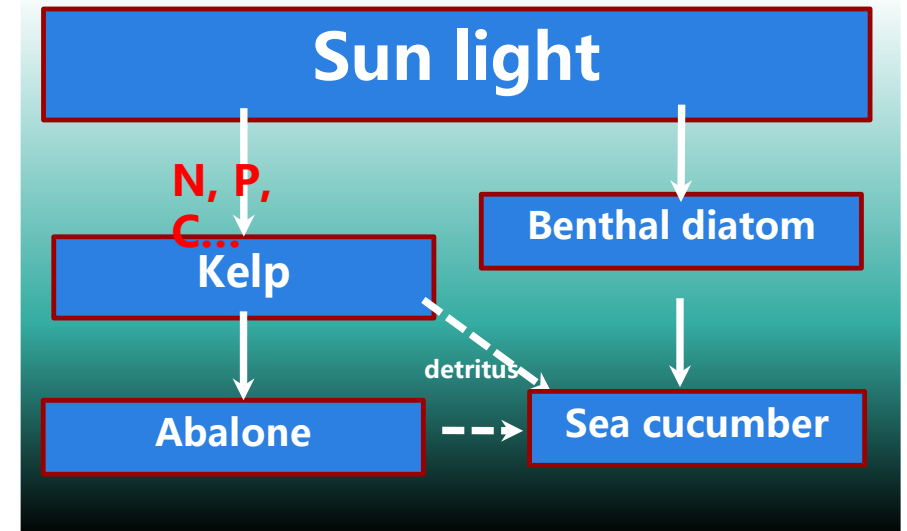
## N, P, C content of kelp

N %	P%	C %
2-3	0.3-0.4	30-35



## Removal of N, P, C by farmed kelp ( ton/ km<sup>2</sup> /a )

<b>Kelp Production</b>	<b>1500</b>	<b>tons DW/km<sup>2</sup></b>
<b>N removal</b>	<b>40</b>	<b>tons N km<sup>-2</sup> year<sup>-1</sup></b>
<b>P removal</b>	<b>5</b>	<b>tons P km<sup>-2</sup> year<sup>-1</sup></b>
<b>C removal</b>	<b>500</b>	<b>tons P km<sup>-2</sup> year<sup>-1</sup></b>



**Kelp Dominated integrated aquaculture**

# Conclusions

- **Kelp is a health food source for human in the future** for meeting the challenges of increasing population and nutrition deficient in the world;
- kelp aquaculture **play a vital role in climate regulating service** by removing CO<sub>2</sub> from seawater through harvest;
- kelp aquaculture **provides a key solution to coastal bio-remediation** by removing N, P from seawater through harvest;
- Kelp aquaculture can **provide more employment opportunities for the low educated group , especially for housewife;**
- .....



**Challenges:** How much can we increase the sustainable harvest of kelp from the ocean?



**Actions:**

- Carrying capacity Based Spatial Planning
- Integrated Multi-trophic Aquaculture (IMTA)
- Ecosystem based coastal management