

# STATE *of the* STATES

## *Status of U.S. Seaweed Aquaculture*

East Coast: Jaclyn Robidoux, Maine Sea Grant

West Coast: Meg Chadsey, Washington Sea Grant

Revised April 6th, 2022

# State of the States Focus

- Farms & Landings
- Permitting & Regulations
  - Note: Seaweed farmers will need to obtain multiple permits and authorizations to get their farms up and running. Only the *lead regulatory agency* is listed for in each state.
- Post Harvest



# E A S T C O A S T

Maine

New Hampshire

Massachusetts

Rhode Island

Connecticut

New York

# W E S T C O A S T

Alaska

Washington

Oregon

California

# East Coast States

Maine, New Hampshire, Massachusetts, Rhode Island,  
Connecticut, and New York

# M A I N E

## F A R M S & L A N D I N G S

**30+**

Active commercial farms, with 100+ sites permitted to grow seaweed or seaweed alongside shellfish.

**500,000 lbs**

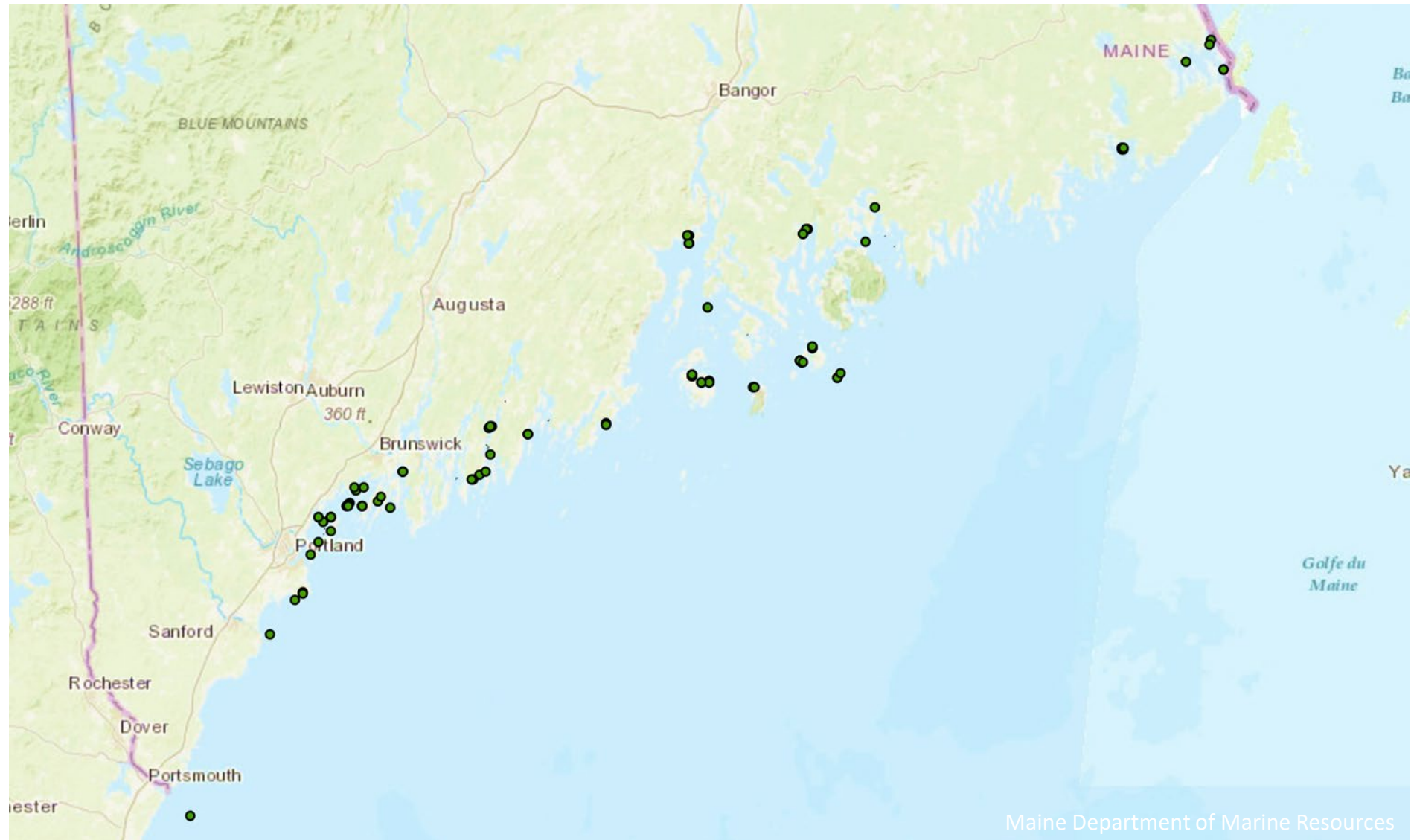
Harvested in the 2020 season (wet weight).

Maine has 4 commercial seaweed nurseries.

Primary species under cultivation: **Sugar Kelp** (*Saccharina latissima*), **Skinny Kelp** (*Saccharina angustissima*), **Winged Kelp** (*Alaria esculenta*).

Maine also has a wild harvest seaweed industry, which harvested over 16 million lbs in 2020 (mostly rockweed).

# MAINE



# MAINE

## PERMITTING & REGULATIONS

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Lead Agency:

**Maine Department of Marine Resources (DMR)**

<https://www.maine.gov/dmr/aquaculture/>

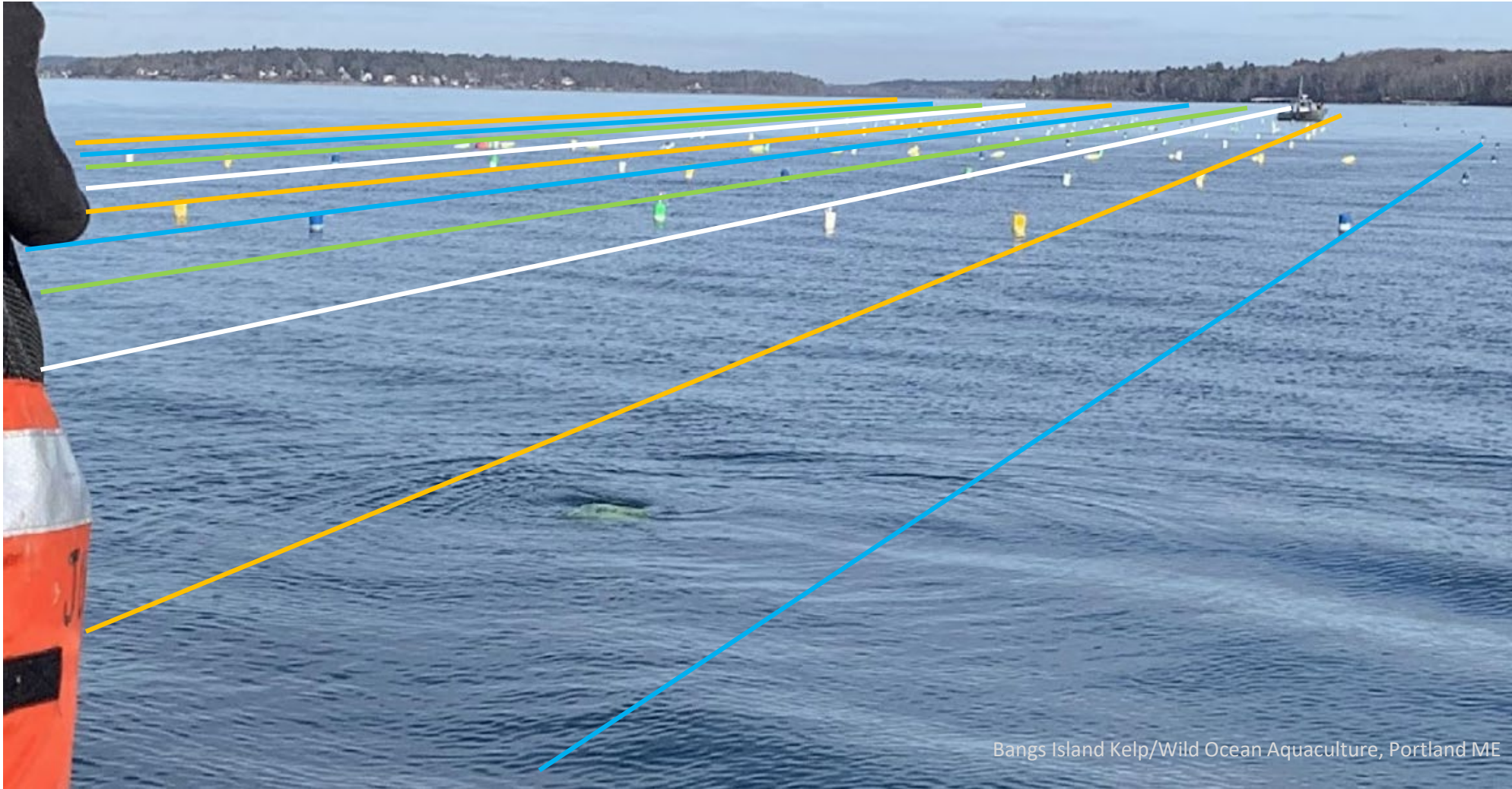
Maine DMR issues licenses and leases for conducting shellfish, seaweed, and finfish aquaculture.

- Licenses have a low barrier to entry but are limited in size and need to be renewed annually. Sites are limited to 400 sq. ft. and need to be renewed annually.
- Leases are larger and are granted for up to 20 years. Farms can be up to 100 acres. Fees are \$500 for first acre, \$50 for each additional acres.

Seaweed cultivated in Maine must be sourced from/native to Maine waters.



# Maine Farm Site



Bangs Island Kelp/Wild Ocean Aquaculture, Portland ME



# M A I N E

## P O S T H A R V E S T

The primary market for Maine seaweed is **value-added, consumer-ready food products.**

Maine has both first-stage processing (ex. drying, blanching, freezing, etc.) and second- stage processing (creation of consumer-ready products)

Increases in processing capacity, product development, and marketing have allowed for stabilization and growth in Maine’s kelp farming industry.

Examples of products produced in Maine include seaweed salads, kimchi, teas, smoothie cubes, snack bars, beverages, and spice blends, as well as dried whole leaf, flakes, powders.

# NEW HAMPSHIRE



**IMTA Site- Integrated Multi-Trophic Aquaculture**

# NEW HAMPSHIRE

## FARMS & LANDINGS

### 5 Commercial Farms.

2 commercial farms (UNH) deployed and sold sugar kelp  
3 commercial farms that did not deploy

### 2 Experimental Farms.

These farms are submerged longlines, with 3 lines per farm.

One farm is located 9 miles offshore as part of a project funded by the **Department of Energy**

Primary species under cultivation: **Sugar Kelp**  
(*Saccharina latissima*)

There is no commercial wild harvest industry

# NEW HAMPSHIRE

## PERMITTING & REGULATIONS

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Lead Regulator:

**New Hampshire Fish and Game (F&G)**

<https://www.wildlife.state.nh.us/>

New Hampshire F&G issues leases for shellfish, seaweed, and finfish aquaculture.

- The fee for conducting aquaculture in NH is \$500/submerged acre/year.
- Size of seaweed leases: No minimum size limit on leases for seaweed

# NEW HAMPSHIRE

## POST HARVEST

The primary market for New Hampshire seaweed is **culinary uses and food products.**

Seaweed is sold to local restaurants and breweries as well as processors in Maine.

Seaweed is seasonally available in fresh/raw forms.

Examples of products produced include kelp beer and fresh kelp in restaurant dishes, as well as value-added products produced in Maine.



# MASSACHUSETTS



Photo credit: Chatham Kelp  
& Edible Cape Cod



Photo credit: Martino Seafood



# MASSACHUSETTS

## FARMS & LANDINGS

### 5 Farms in 2021

Two of these farms are standalone kelp farms and three farms are within an existing shellfish farm. These are all commercial sites.

### ~9,500 lbs

Harvested in 2021 for both human consumption and use in fertilizer products.

Primary species under cultivation:

**Sugar Kelp** (*Saccharina latissima*)

There is no commercial wild harvest industry, though there was historically.

# MASSACHUSETTS

## PERMITTING & REGULATIONS

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Lead Regulator:

**Massachusetts Division of Marine Fisheries (DMF)**

<https://www.mass.gov/service-details/aquaculture>

Massachusetts DMF works directly with the municipalities and issues a Class 4, Type 2 Commercial Aquaculture Permit for seaweed.

Largest site permitted currently is 27 acres.

# MASSACHUSETTS

## POST HARVEST

The primary market for Massachusetts seaweed is **Food products, and fertilizers**

Seaweed is sold: raw and fresh. Though has been dried and examined for use in food additives and skin care products.

In Massachusetts, sugar kelp must be sold directly to a wholesale seafood dealer to be a food product per Department of Public Health (DPH) food protection and DMF regulations.

# RHODE ISLAND



Photo: Humphries, 2017 / University of Rhode Island

**Juvenile Kelp**

# R H O D E I S L A N D

## F A R M S & L A N D I N G S

### 10 Permitted Farms

10 farms are permitted in Rhode Island, but only 3 are growing kelp this year.

### 7,000 lbs

Sugar kelp landings for 2020.

Primary species under cultivation:

**Sugar Kelp** (*Saccharina latissima*)

There is no commercial wild harvest industry.

Seed source: self-propagated, private supplier, and university



ME

NH

MA

RI

CT

NY

AK

WA

OR

CA

# R H O D E I S L A N D

## PERMITTING & REGULATIONS

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Lead Regulator:

**Rhode Island Coastal Resources Management Council  
(CRMC)**

<http://www.crmc.ri.gov/aquaculture.html>

Rhode Island CRMC issues shellfish and seaweed leases on state submerged land.

- Leases can be for 15 years, with yearly lease fees.

Due to growth in shellfish aquaculture, the state caps the acreage of aquaculture activities in coastal ponds at 5% of the total open water surface area.

Size of permitted farms: 2.0 to 9.6 acres



# R H O D E I S L A N D

## P O S T H A R V E S T

Farmed seaweed in Rhode Island primarily goes to:

### **Processors**

Seaweed is sold: freshly harvested / raw to processors, chefs, and consumers

A 2017 RI market study found that there was high interest from institutional buyers, but these buyers needed **shelf-stable products at high volumes.**

In Rhode Island, kelp processors ability to purchase fresh product is the limiting factor for kelp farms.

# CONNECTICUT



Photo: Judy Benson / Connecticut Sea Grant

***Gracilaria* Research**

# C O N N E C T I C U T

## F A R M S & L A N D I N G S

### 15 Permitted Sites.

Of these sites, 4 farms deployed sugar kelp seed-string this year. In addition, Connecticut has 13 companies and 1 nursery.

**Landings unknown:** Connecticut does not require landings to be reported.

Species under cultivation: **Sugar Kelp** (*Saccharina latissima*) and **Gracilaria** (*Gracilaria tikvahiae*), in tank cultures only.

There is no commercial wild harvest industry.



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# CONNECTICUT

## PERMITTING & REGULATIONS

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Lead Regulator:

**Connecticut Department of Agriculture, Bureau of Aquaculture**

<https://portal.ct.gov/DOAG/Aquaculture1/Aquaculture/Seaweed/Seaweed>

Kelp-only licenses are issued and are good for 5 years.

- Cultivation for seaweed is based on the Connecticut shellfish model and can only occur in approved or conditionally-approved waters.
- Size of permitted farms: 2-9 acres

# C O N N E C T I C U T

## P O S T H A R V E S T

The primary market for CT seaweed is  
**Food and food products.**

Seaweed is sold: raw, blanched, and cut

Seaweed in Connecticut is sold as a Raw Agricultural Commodity. In addition, seaweed is sold as kelp noodles. Some of the product is sold as fertilizer.

Connecticut is investigating **kelp powder** for use as a food additive and in cosmetics.



# CONNECTICUT



**Blanched Kelp Stipes**



# NEW YORK



Photo: Michael Doall, Stony Brook University

**Research Farm Site**

# NEW YORK

## FARMS & LANDINGS

New York does not have any permitted commercial seaweed farms, but does have two research sites at Stony Brook University's School of Marine and Atmospheric Sciences.

### 1000 lbs

Of sugar kelp was cultivated at 3 oyster farm sites.

Major species under cultivation: **Sugar Kelp** (*Saccharina latissima*) and **Gracilaria** (*Gracilaria tikvahiae*).

New York's first kelp hatchery is located at SBU's Southampton Marine Station. In 2019, the hatchery produced **over 40 spools**.



# NEW YORK



Photo: Michael Doall, Stony Brook University

**Southampton Marine Station Hatchery Spools**



# NEW YORK



**Research Farm Site**

# NEW YORK

## PERMITTING & REGULATIONS

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New York does not currently permit seaweed farms.

Prospective Lead Regulator:

**New York State Department of Environmental Conservation**

<https://www.dec.ny.gov/63.html>

Commercial seaweed cultivation in New York ***requires a change*** to the state Environmental Conservation Law (ECL).

# West Coast States

Alaska, Washington, Oregon, and California



# ALASKA



Photo: Gary Freitag

**Kelp Nursery**

# ALASKA

## FARMS & LANDINGS

**2021 Sales: 536,390 lbs of seaweed (up from 231,015 in 2020)**

### Active Farms in 2021

- Seaweed only: 11 issued permits, 5 farming
- Seaweed/Shellfish: 17 issued permits, 14 farming
- Seaweed nurseries: 4 active (two land-based; two floating)
- New applications under review
  - i. Seaweed only: 18
  - ii. Seaweed/Shellfish: 5

Primary species under cultivation: **Sugar Kelp** (*Saccharina latissima*) and **Ribbon Kelp** (*Alaria marginata*), and **Bull Kelp** (*Nereocystis leutkeana*).



# ALASKA



Photo: Gary Freitag

**Bull Kelp Farm**



# ALASKA



Photo: Gary Freitag

**Bull Kelp Farm**

# ALASKA

## PERMITTING & REGULATIONS

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Lead Regulator:

**Alaska Department of Natural Resources (DNR)**

<http://dnr.alaska.gov/mlw/aquatic/>

Alaska DNR issues leases for aquatic farm sites in the state, including sites for aquatic plants.

- The lease terms is 10 years.
- Lease fee is \$450 for the first acre, \$125 for each additional acre.

Alaska Department of Fish and Game issues permits for commercial wild harvest of seaweeds.





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# ALASKA

## POST HARVEST

### **Food-use**

The primary market for Alaska seaweed is for human consumption.

Companies produce

### **Value-added food products**

like seaweed salsa, hot sauce, and dried kelp seasonings.

Seaweed is sold: dried, blanched, and frozen

# WASHINGTON



Photo: John Mickett

**Blue Dot Sea Farms, Hood Canal, WA**

# WASHINGTON

## FARMS & LANDINGS

### Open Water: Blue Dot Sea Farms

In 2021, Blue Dot Sea Farms (formerly Hood Canal Mariculture) transitioned to become Washington's first open water commercial seaweed farm in 30 years.

Primary species under cultivation: **Sugar Kelp** (*Saccharina latissima*) and Pacific oysters (marketed through Baywater Shellfish Farm).

Sugar Kelp landings: 14,000 lbs (2017); 15,000 lbs (2020); and 10,000 (2021)

# WASHINGTON



Photo: Washington Sea Grant / SolSea

**SolSea LTD Tank Cultured Red Algae**

# WASHINGTON

## FARMS & LANDINGS

### Tank Culture: SolSea LTD

Combined propagation/research facility at NOAA's Manchester Research Station.

Primary species under cultivation:

*Chondracanthus* (Turkish towel), Dulse, and *Ulva*. Research incubators recently dedicated to continuous seasonal culture of Sugar Kelp and Bull Whip (aka Bull Kelp).

Annual production capacity: 28 metric tons of *Chondracanthus* and Dulse (reduced during pandemic). Over 2000 lbs (multiple species) harvested for NOAA research.



# WASHINGTON

## PERMITTING & REGULATIONS

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**Joint Aquatic Resources Permit Application (JARPA)** - Permit applications are funneled to the various agencies and stakeholders through the state JARPA process. Permits are ultimately granted by the US Army Corps of Engineers.

[www.epermitting.wa.gov/site/jarpa/9983/jarpa.aspx](http://www.epermitting.wa.gov/site/jarpa/9983/jarpa.aspx)

**Washington Department of Natural Resources** - WDNR leases are required for all farms on state-owned aquatic lands. Leases may be granted for up to 30 years. Note that ~50% of Washington tidelands belong to Treaty Tribes or private landowners; prospective growers are advised to consult with local county planning offices about tideland ownership.

[http://www.dnr.wa.gov/programs\\_and\\_services/aquatics/leasing\\_and\\_land\\_transactions](http://www.dnr.wa.gov/programs_and_services/aquatics/leasing_and_land_transactions)

# WASHINGTON

## POST HARVEST

**Blue Dot Sea Farms** - 100% of Blue Dot' Sea Farms' sugar kelp harvest is currently utilized for *Seacharrones*, a new kelp snack produced by Blue Dot Kitchens (available through retail outlets in March 2022).

**SolSea LTD** - tank system produces seaweed for:

**High-end skincare** - proprietary face and body bars, gels and serums, moisturizer (SEAME brand)

**Upmarket restaurant-quality food** - including value-added products and snacks (limited to product development due to pandemic)

**Research** - fish feeds, high-end fertilizers, abalone and oyster cultivation.

# OREGON



Photo: Stephen Ward / Oregon State University

**West Coast  
Dulse**

# OREGON

## FARMS & LANDINGS

*Currently, there are no ocean-based seaweed farms permitted in Oregon.*

### 3 Land-Based Farms

Since 2016, there has been significant growth in land-based dulse farming in Oregon.

Access to a consistent supply of high-quality seawater is the main limiting factor for these land-based systems.

Primary species under cultivation:

**Dulse** (*Palmaria mollis*)

The Land-based farms consist of anywhere between 5 and 10 10,000 liter tanks.

# OREGON

## PERMITTING & REGULATIONS

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Lead Regulator:

**Oregon Department of State Lands (DSL)**

<https://www.oregon.gov/dsl/WW/Pages/Waterways.aspx>

Oregon DSL issues special use leases or licenses.

- Leases can be from 1-30 years.
- Licenses grant non-exclusive use of state lands. A license can only be granted for less than 3 years.



# OREGON

## POST HARVEST

Seaweed grown in tank systems goes to primarily to

**Local restaurants**

**And is shipped out of state.**

Seaweed is sold: fresh/raw and dried

The seaweed is used as ingredients in restaurant dishes and in health food supplements.

# CALIFORNIA



**Red Ogo Produced in Tank**

# CALIFORNIA

## FARMS & LANDINGS

### 4 Farms/Businesses

California also has tank culture operations, like Monterey Bay Seaweeds. No ocean farmed seaweed is available.

Primary species under cultivation: **Red Ogo** (*Gracilaria pacifica*), **Sea Lettuce** (*Ulva spp.*), **Dulse** (*Palmaria mollis*)

### Giant Kelp:

Commercial wild kelp harvest exists for Giant Kelp (*Macrosystis pyrifera*). 25 metric tons of edible algae were wild harvested in 2015.

# CALIFORNIA



Photo: Moss Landing Marine Laboratories / Monterey Bay Seaweeds

**Tank Culture**



# CALIFORNIA

## PERMITTING & REGULATIONS

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Lead Regulator:

**California Department of Fish and Wildlife (DFW)**

<http://wildlife.ca.gov/aquaculture>

California DFW coordinates permits/approvals for farms in state waters. They work with the California Fish and Game Commission who issues bottom leases in most areas. In some cases, the harbor/port districts may administer leases.

- Maximum lease term is 25 years (10 for marine finfish aquaculture).
- Lease process triggers an environmental review under CA law.

California requires an Aquaculture Registration through the DFW for all aquaculture businesses.

California DFW also regulates the harvest of kelp and other aquatic plants.

# CALIFORNIA

## POST HARVEST

Seaweed in California is a niche market; sold to **restaurants and direct to consumers.**

Seaweed sold for food purposes is mostly fresh/raw.

Some of California's wild harvest kelp is not used for food purpose/non-edible.