

STATE *of the* STATES

Status of U.S. Seaweed Aquaculture

East Coast: Jaclyn Robidoux, Maine Sea Grant

West Coast: Meg Chadsey, Washington Sea Grant

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

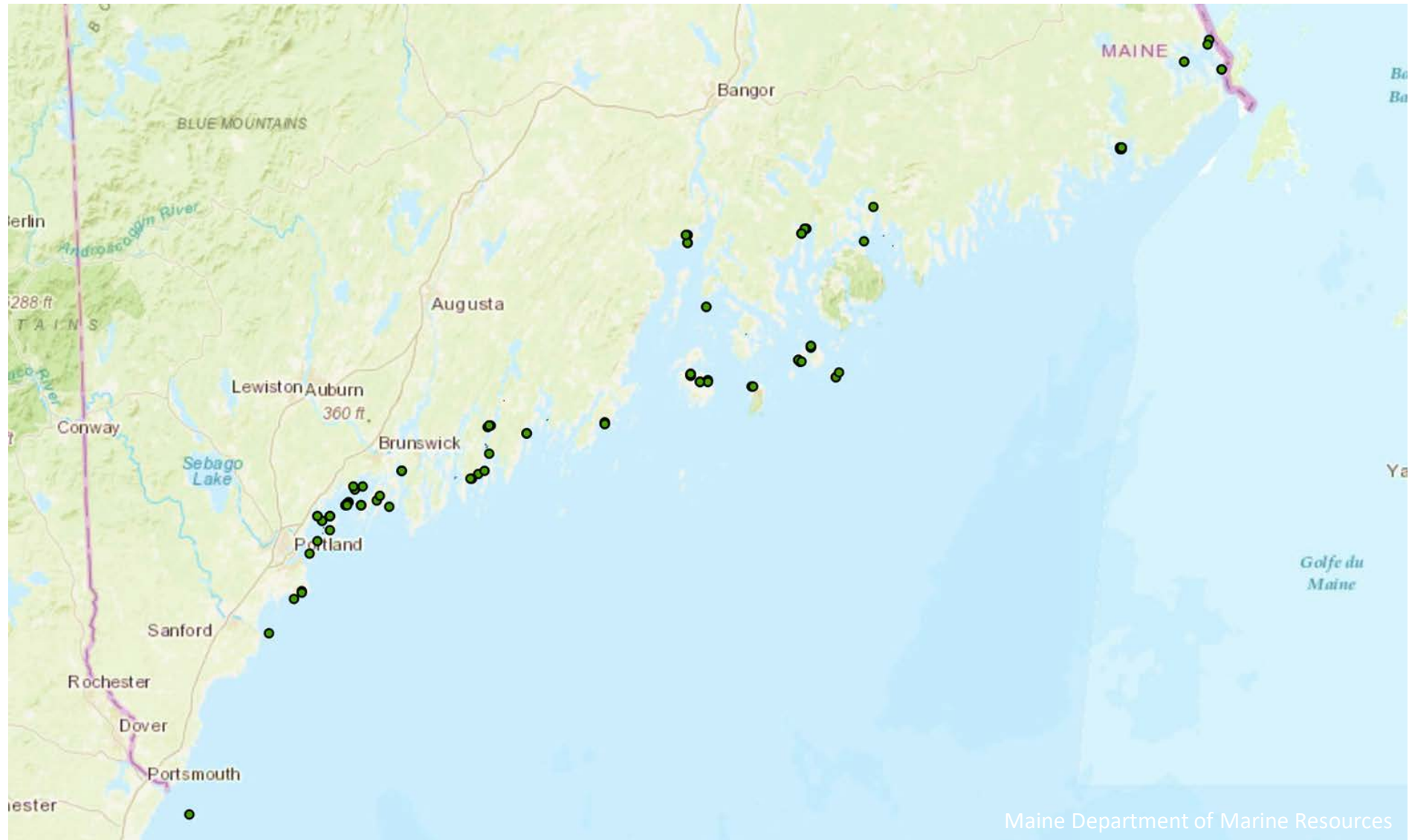
California

East Coast States

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

ME
NH
MA
RI
CT
NY
AK
WA
OR
CA

MAINE



M A I N E

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

200+

Sites permitted to grow seaweed or seaweed with shellfish.

325,000 lbs

Harvested in the 2019 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 22,000,000 lbs in 2019 (mostly Rockweed).

MAINE

PERMITTING & REGULATIONS

Lead Regulator:

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.

ME

NH

MA

RI

CT

NY

AK

WA

OR

CA

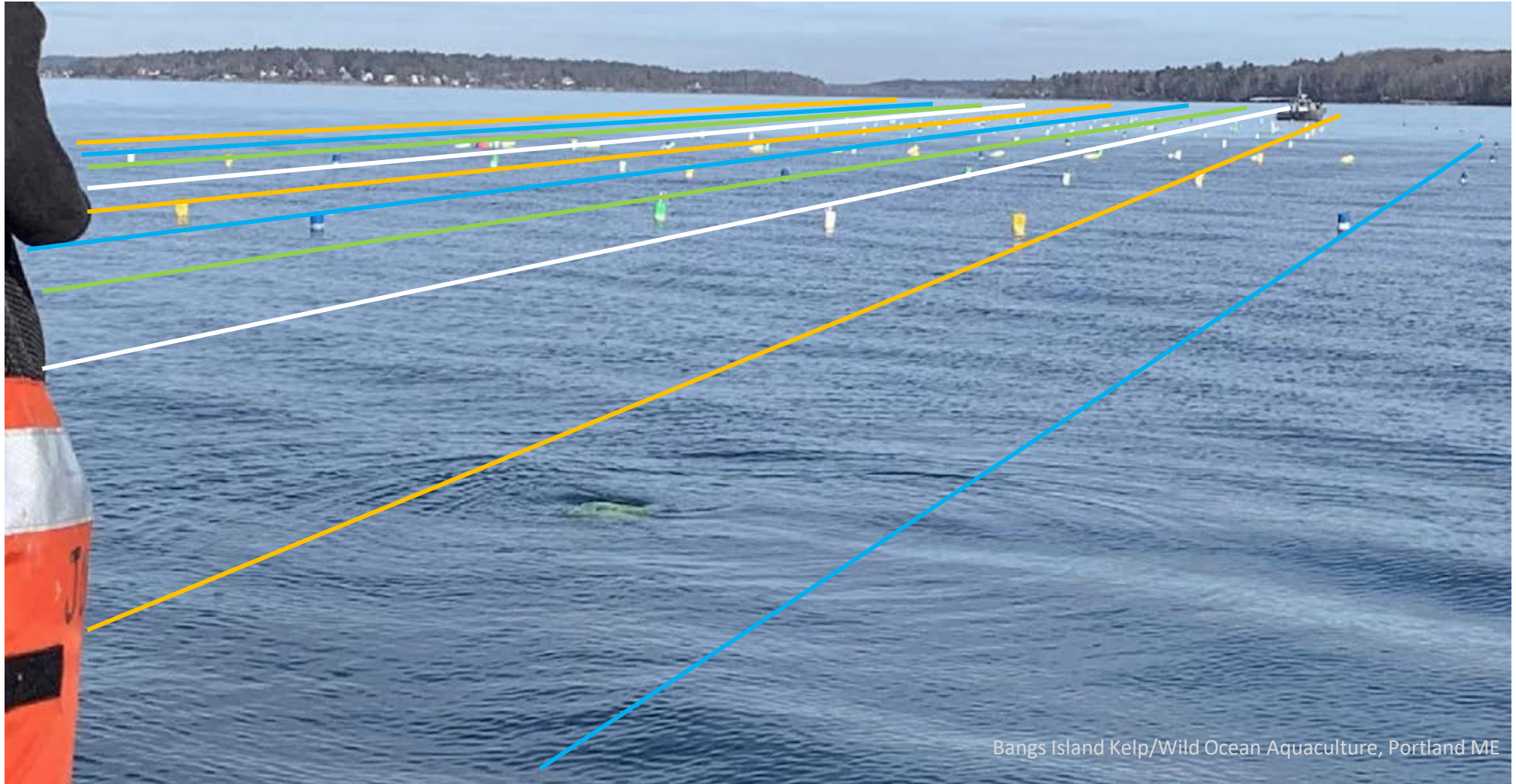
Maine License Site



Spartan Sea Farms, Freeport ME

ME
NH
MA
RI
CT
NY
AK
WA
OR
CA

Maine Lease Site



MAINE

POST HARVEST

The primary market for Maine seaweed is
Value-added food products.

Seaweed is sold: raw, dried, blanched, frozen, fermented.

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

The market for “raw” or “fresh” products is growing in Maine.

NEW HAMPSHIRE



IMTA Site- Integrated Multi-Trophic Aquaculture

NEW HAMPSHIRE

FARMS & LANDINGS

3 Research Farms.

There are currently no commercial growers in NH.

Two of these farms are submerged longlines, with 3 lines per farm. The third system is an IMTA raft that grows kelp, and dulse alongside mussels and finfish.

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

In fall 2020, NH will be deploying kelp farm 9 miles offshore, as a part of a project funded by the
Department of Energy.

NEW HAMPSHIRE

PERMITTING& REGULATIONS

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: Currently 1/10th acre

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

FARMS & LANDINGS

4 Farms

Three of these farms are standalone kelp farms and one farm is within an existing shellfish grant. Three of these farms are commercial farms and one is a research farm run by Woods Hole Oceanographic Institute.

<1,000 lbs

Less than 3 farms harvested for 2019 so this number is not official, but this is the estimated level of commercial harvest for 2019.

Primary species under cultivation:

Sugar Kelp (*Saccharina latissima*)

There is no commercial wild harvest industry.

MASSACHUSETTS

PERMITTING & REGULATIONS

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.

Size of permitted farms: up to 45 acres.

MASSACHUSETTS

POST HARVEST

The primary market for Massachusetts seaweed is **Restaurants.**

Seaweed is sold: raw and fresh.

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

ME
NH
MA
RI
CT
NY
AK
WA
OR
CA

R H O D E I S L A N D



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.

13,447 lbs

Sugar kelp landings for 2019.

Primary species under cultivation:

Sugar Kelp (*Saccharina latissima*)

There is no commercial wild harvest industry.

R H O D E I S L A N D

PERMITTING& REGULATIONS

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

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**

CONNECTICUT

FARMS & LANDINGS

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.

CONNECTICUT

PERMITTING& REGULATIONS

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.

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CONNECTICUT



Blanched Kelp

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OR
CA

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

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OR
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NEW YORK



Photo: Michael Doall, Stony Brook University

Research Farm Site

NEW YORK

PERMITTING& REGULATIONS

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

ME
NH
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RI
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OR
CA

ALASKA



Photo: Gary Freitag

Kelp Nursery

ALASKA

FARMS & LANDINGS

22 Permitted Sites

As of May 2019, Alaska had 14 additional proposed farm projects, including amendments to existing farm operations.

~250,000 lbs

Produced in 2019. 2018 landings were 89,279 lbs.

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

ME
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ALASKA



Photo: Gary Freitag

Bull Kelp Farm

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OR
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ALASKA



Photo: Gary Freitag

Bull Kelp Farm

ALASKA

PERMITTING& REGULATIONS

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.

A L A S K A

P O S T H A R V E S T

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

ME
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OR
CA

WASHINGTON



Photo: Washington Sea Grant / Hood Canal Mariculture

Hood Canal Mariculture

WASHINGTON

FARMS & LANDINGS

1 Open-water Farm

In 2019, this farm became Washington's first open water commercial facility in 30 years.

14,000 lbs

were harvested in 2017.

Primary species under cultivation: **Sugar Kelp** (*Saccharina latissima*) and **Bull Kelp** (*Nereocystis leutkeana*)

SolSea

is a tank culture operation and propagation facility at NOAA's Manchester Research Facility. The systems annual production is 28 metric tons of ***Chondracanthus***.

WASHINGTON



Photo: Washington Sea Grant / SolSea

SolSea Tank Culture System and Red Algae

WASHINGTON

PERMITTING& REGULATIONS

Lead Regulator:

Washington Department of Natural Resources (DNR)

<https://www.dnr.wa.gov/programs-and-services/aquatics/leasing-and-land-transactions>

Washington DNR leases are required for all farm operations on state-owned aquatic lands.

- A lease can be for up to 30 years.

Hood Canal Mariculture converted an existing shellfish permit to a kelp cultivation experiment in 2017.

WASHINGTON

POST HARVEST

There are no established markets for ocean-cultivated WA seaweed yet.

The SolSea tank system grows products for two markets:

High-end skincare

including face and body bars, gels and serums, moisturizer

Upmarket restaurant quality food

including value-added food products and snacks

WA companies are testing new seaweed products for the retail markets, keeping in mind shelf life and food safety.

ME
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CA

OREGON



Photo: Stephen Ward / Oregon State University

West Coast Dulse

O R E G O N

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

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

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.

O R E G O N

P O S T H A R V E S T

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



Photo: Monterey Bay Seaweeds

Red Ogo Produced in Tank System

ME
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RI
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WA
OR
CA

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 System

CALIFORNIA

PERMITTING& REGULATIONS

Lead Regulator:

California Department of Fish and Wildlife (DFW)

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

California DFW administers the lease process for state owned submerged lands. In some cases, however, the local harbor master or a federal agency may administer the lease.

- 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 aquaculture on private and state owned submerged lands.

California 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.