Seaweed Raw Agricultural Commodity Hazards Guide 2025

Photo credit: Sugar Kelp | NOAA Fisheries

CONNECTICUT GROWN
A Way of Life

Prepared by the Connecticut Department of Agriculture, Bureau of Aquaculture

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The original Seaweed Hazards Guide was developed by Connecticut Sea Grant in partnership with the Connecticut Department of Agriculture, Bureau of Aquaculture (DoAg). This updated version provides an overview of the regulatory framework and requirements for seaweed cultivation, harvest, and market as a **raw agricultural commodity (RAC)** in Connecticut. This guidance document represents the DoAg's assessment of hazards, critical control points (CCPs) and critical limits (CLs) associated with the production of seaweed as a RAC in Connecticut.

Definitions:

- Sugar kelp (*Saccharina latissima*) is a brown algae that is typically cultivated on long lines from the fall-spring in New England, as its upper temperature tolerance is around 15℃ (59℉). Sugar kelp is currently the only algae cultivated in Connecticut for human consumption.

- Raw seaweed is defined as seaweed that is an approved species sold by the agricultural unit (i.e. by the blade), not by weight or volume, in an unsealed bag or box. Raw seaweed production is regulated by the Connecticut Department of Agriculture, Bureau of Aquaculture (DoAg). The DoAg only permits the cultivation of seaweed in areas classified as Approved or Conditionally Approved through the state shellfish sanitation program; wild harvest is not permissible under the Seaweed Producer license. <u>In order to be considered a raw agricultural commodity (RAC), the kelp must be refrigerated within 5 hours of starting harvest or 2 hours within returning to the dock, whichever is shorter.</u>

- Processed Seaweed Commodity is defined as seaweed that is an approved species in a processed form (cut, blanched, cooked, dried, frozen), may be sold packaged in a sealed bag, and may be sold by weight or volume (e.g., by the ounce). In consideration of the regulatory structure in Connecticut, raw seaweed that has been packaged in any way other than what is allowed for a Raw Agricultural Commodity is considered to be a processed seaweed commodity and is subject to additional Connecticut Department of Consumer Protection (DCP) licensing and regulatory oversight. Processed seaweed must meet all requirements of a raw agricultural seaweed commodity in addition to the requirements of DCP and/or local health department, who have regulatory authority over processed seaweed wholesale and retail sales in their jurisdiction, respectively.

    - The Department of Consumer Protection (DCP) has determined that a water activity of 0.85 or lower is considered a dried seaweed product, and therefore, would be processed and not fall under the definition of a RAC.

- Local seaweed seed source is defined as originating from a Connecticut hatchery and utilizing reproductive tissue collected from the waters of Long Island Sound, east to the southern-most land point of Rhode Island and Massachusetts. The majority of Seaweed Producers in Connecticut rely on a limited number of hatcheries that produce seed spool strings for the local industry.

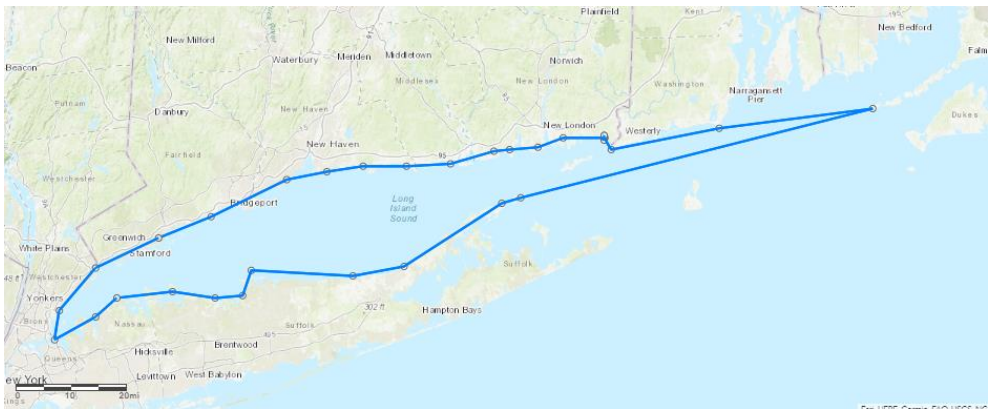


Figure 1. Acceptable local seaweed source locations for collecting <u>reproductive tissue</u> for cultivation in Connecticut. Wild harvest for sale as a RAC is not permissible under the Seaweed Producer license.

Overview of Regulatory Framework:

Multiple state and federal agencies are involved with regulating aquaculture, including seaweed production. In Connecticut, applicants must complete a lengthy process before even starting seaweed cultivation. In Connecticut, only sugar kelp is currently being cultivated in Long Island Sound. While *Gracillaria* was investigated as a potential aquaculture seaweed, it became heavily fouled in Long Island Sound and consequently was not a viable product. DoAg will license *Gracillaria* culture in tanks upon receipt of appropriate documentation. No other species are approved for cultivation by DoAg, as species-specific testing and critical limits would need to be established prior to allowing production for human consumption.

Prior to becoming a seaweed producer, the applicant must:

- Identify a cultivation location in Approved or Conditionally Approved waters using the CT aquaculture mapping atlas. The DoAg classifies shellfish growing areas in accordance with national standards; Approved and Conditionally Approved areas are certified for direct shellfish harvest, which is why the areas are also permitted for seaweed cultivation.
    - CT does not permit wild harvest of seaweed for consumption.
- Contact DoAg for assistance in site selection, refinement of company startup plans, and completing the Joint Agency Application to Conduct Marine Aquaculture in Connecticut. portal.ct.gov/-/media/doag/aquaculture/aquaculture-permitting-and-guidance/joint-agency-application-to-conduct-marine-aquaculture-in-connecticut.pdf
    - **Nothing can be placed in Long Island Sound until the company has an approved permit and has acquired a Seaweed Producer license from DoAg. The Joint Agency Application can be a lengthy process that may take over one year.**

Seaweed longlines require a full permit from the Army Corps of Engineers (ACOE) because they impact navigation and fish and wildlife (consultations with NOAA, EPA, FWS). Concurrently, a review and determination of need and authorization through US Coast Guard for Private Aids for a Navigation Permit will occur. During this review process, the applicant must:

- Complete HACCP (Hazard Analysis and Critical Control Points) training through CT Sea Grant. Throughout this document, the reader will be directed to specific sections of the FDA Hazards Guide (Fish and Fishery Products Hazards and Controls | FDA) which go into further detail regarding the topic or hazard in question.
    - For information about seafood HACCP training courses offered by Connecticut Sea Grant, email nancy.balcom@uconn.edu.
- Begin identifying the equipment needed to successfully establish a seaweed company (i.e. boat of suitable size; the amount of anchors of appropriate weight, floats, and longlines needed; etc.)

Once an ACOE permit has been issued, the applicant must contact the DEEP Boating Division to complete a navigation marker permit application: Navigation Marker Permit. No gear can be placed in the ACOE permitted area until it has been marked in accordance with the Navigation permit.

- The ACOE permit outlines the location and size of the gear, cultivation timeframe, and other specified criteria that the application must comply with. To modify any of this information, the applicant must submit a formal modification request.
- To expand to a different location in Long Island Sound, or beyond the boundaries of your existing permit, a new Joint Agency Application must be completed, which will again require a lengthy review process of over one year.

Upon receipt of Navigation Permit AND marking of the site in accordance with the permit, the applicant may begin cultivating seaweed by:

- Identifying a source of kelp seed spool strings authorized by DoAg.
- Placing gear in accordance with ACOE permit in preparation for planting in the fall.
    - No seaweed can be cultivated until the applicant has a Seaweed Producer license from DoAg; however, gear can be deployed in the water in preparation once the ACOE and Navigational permits have been issued.
- Apply for a Seaweed Producer license from DoAg: Seaweed. The following documents must be submitted in the application process on elicense; the DoAg provides example documents to assist first-time applicants (outlined below):
    - Process document and flow chart outlining steps from harvest to sale
    - Fertilizer/type and ingredients if used in tank cultivation (provide copy or photo of label)
    - Well water test results if well water is used for rinsing kelp (well water must be tested twice a year; testing requirement does not apply to public water supply)
    - Detailed facility diagram/plan/schematic (for land-based facilities)
    - HACCP certification
    - HACCP plan for seaweed production as a raw agricultural commodity
    - Sanitation Standard Operating Procedures (SSOPs) and/or Best Management Practices (BMPs) for seaweed production
    - Written recall plan: Allows product to be traced back and recalled in case of illness or potential risk
    - Example of label/tag/identification for seaweed product

Once the Seaweed Producer license has been issued, the applicant may place the seed string(s) on their gear. **The Seaweed Producer license only permits the cultivation and sale of raw, unprocessed kelp.**

In preparation for harvesting:

- Identify sale avenues and state and local regulations, as appropriate (wholesale, retail, farm market, etc.). Ensure any other state or local permits are in place prior to the harvesting season to prevent potential delays.
- Maintain gear throughout the growing season. The permit holder is responsible for ensuring gear placement is in accordance with their permit and that gear and kelp are not lost.
- In the spring, provide a sample to DoAg for heavy metal and microbiological testing, at the request of DoAg.
- Ensure adequate harvesting, packaging, and sanitation supplies are on hand.
- Any company that wishes to produce any processed products (i.e. anything other than raw, unprocessed kelp), which includes but is not limited to **cutting**, drying, freezing and blanching, must go through the appropriate regulatory channel prior to processing kelp. **The Department of Consumer Protection (DCP) is responsible for certifying companies that want to process kelp for wholesale distribution, and local health departments are responsible for regulating retail sales of processed kelp under their jurisdiction.**
- Any company that wishes to use seaweed as an agricultural product (soil amendment, additive, fertilizer, biostimulant, etc.) shall seek the appropriate licensing.
- Any company that wishes to use the product as compost shall seek the appropriate licensing.
- Kelp is not a federally regulated product at this time. The DoAg does not certify kelp or kelp products to be transported across state lines.
    - In 2021, the U.S. Food and Drug Administration (FDA) declared harvested seaweed to be a Raw Agricultural Commodity (RAC) falling within the farm definition in 21 CFR Part

1.227 (Janasie, 2022), meaning producers selling seaweed in an unprocessed (raw) form may be exempt from additional regulatory requirements. In alignment with FDA's declaration, DoAg regulates cultivated seaweed as a RAC unless processing, as per FDA Food Safety Modernization Act (FSMA) – Preventive Controls for Human Foods (PCHF) rules dictates, is conducted. Additional information about PCHF rules for processed kelp is available Seafood-Guide-Seaweed-I.pdf.

During the harvesting season:

- Every day, prior to harvest, call the DoAg status hotline(s) for the Approved or Conditionally Approved areas where your seaweed is cultivated. Kelp cannot be harvested when the area is in the closed status. The DoAg closes Conditionally Approved areas following rainfall events greater than established rain triggers, sewage bypasses, and other predictable or emergency events that could introduce pollution into the growing area. DoAg precautionarily closes Approved areas after ≥3.0" rain. The DoAg completes fecal coliform and/or viral sampling of the growing area prior to reopening to demonstrate that the temporary pollution event has ended.
    - Greenwich-Branford – DoAg office (203-874-0696), select option 5 through the auto attendant (status of commercial openings by town) and follow the prompt.
        - Branford – 2
        - West Haven, New Haven, East Haven, Milford and Stratford – 3
        - Fairfield – 4
        - Westport, Norwalk and Darien – 5
        - Stamford and Greenwich – 6
    - Guilford – (203-453-8088) maintained by the Town of Guilford
    - Madison – (203-245-5600), ext. 3 – maintained by the Town of Madison
    - Waterford and East Lyme – (860-444-5812) maintained by the DoAg
    - Groton – (860-441-6793) maintained by the shellfish commission
    - Stonington – (860-599-7575) maintained by the shellfish commission
- Raw seaweed has a short shelf-life and needs to be harvested and sold quickly. Ensure buyers are lined up in advance and there is adequate staff to meet supply and demand during the short harvesting season.
    - Raw seaweed is sold by the agricultural unit (i.e. sold by the blade), not by weight or volume, in an unsealed bag or box. The intended use of raw seaweed is to be sold and eaten as is.
- Follow the SSOP and HACCP documents submitted to and approved by DoAg in the Seaweed Producer application process to maintain sanitary conditions and prevent potential food-borne illnesses. Raw food products inherently carry risks of human illness from consumption of contaminated product. Compliance with these documents is critical.
- Maintain harvesting, HACCP, sanitation, temperature and all other records required by regulatory authorities and make those records available for review by regulatory authorities.

Until federal guidance specific to seaweed production and processing in the U.S. is developed, the State will continue to require all seaweed producers and processors in Connecticut to develop seaweed HACCP plans based on the requirements outlined in this Seaweed Hazard Guide.

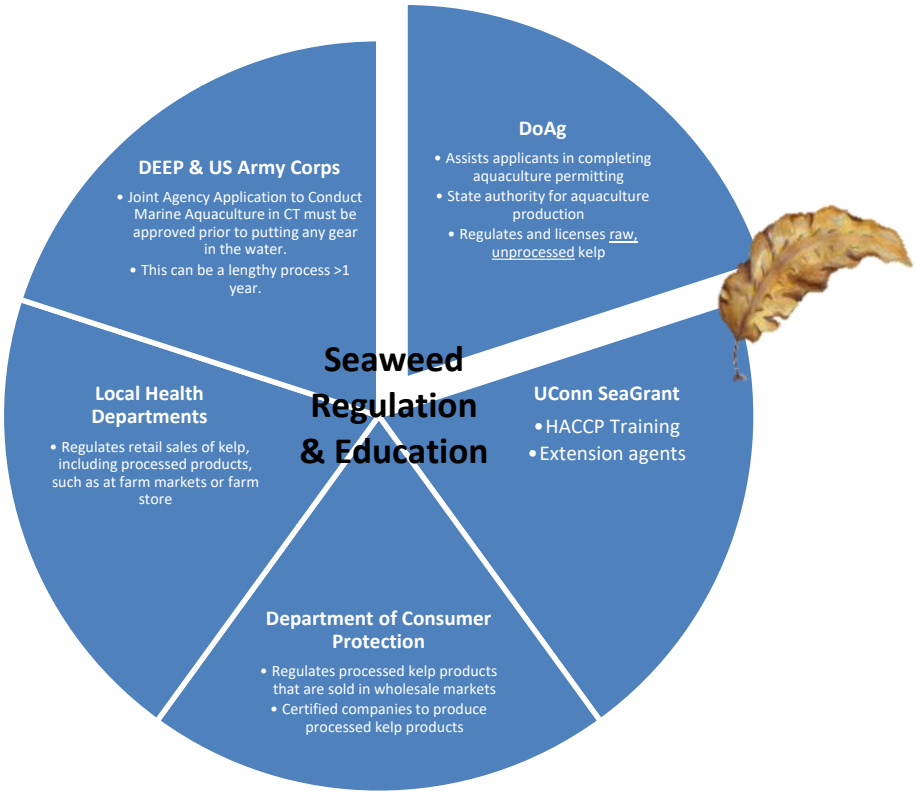
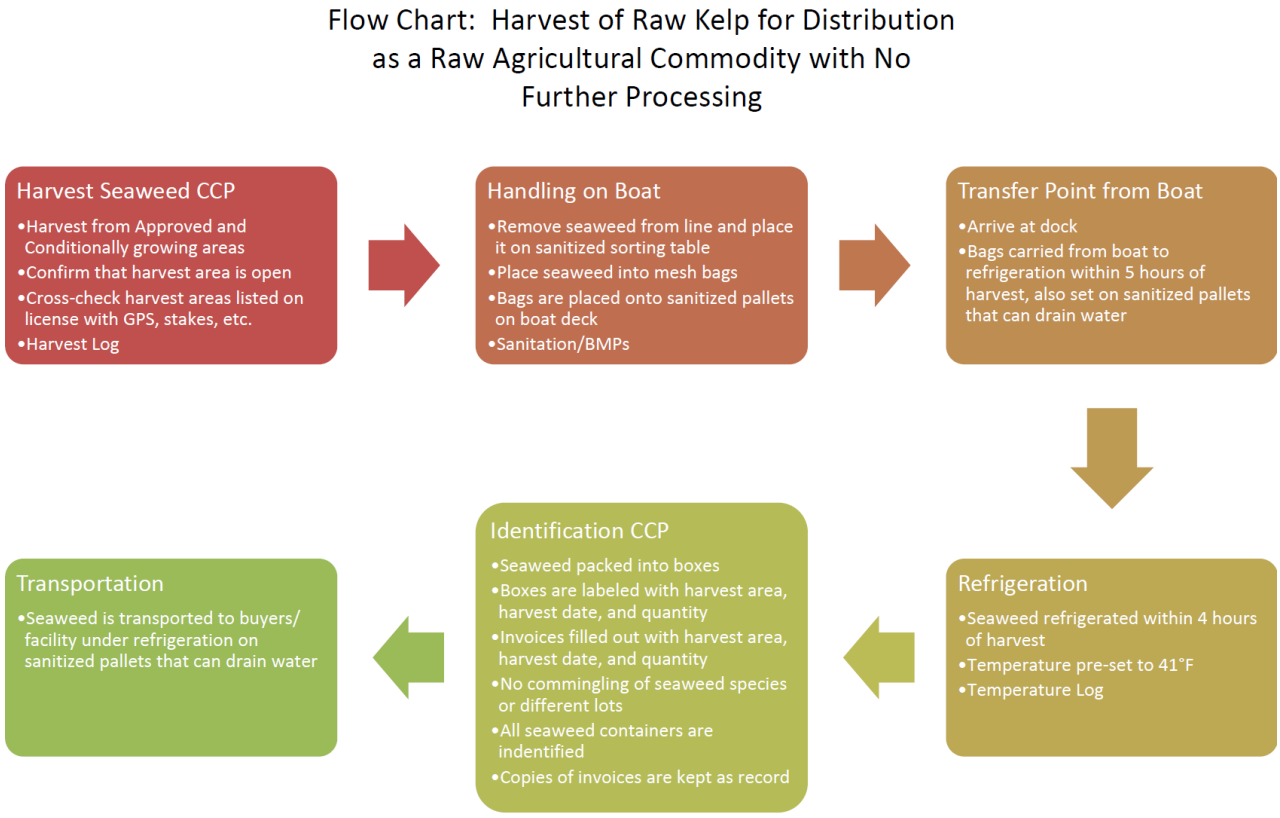


Figure 2. State, federal, and local agencies that regulate seaweed production or processing in Connecticut. These agencies all play an important and distinct role in regulating seaweed; it is important to understand the regulations and permitting each agency requires. UConn SeaGrant extension agents provide HACCP training courses.

Harvest to Market Flow Chart for Raw Seaweed

Applying the principles taught in seafood HACCP, a description and flow diagram must be developed for the cultivation, harvest, and market of raw seaweed. These steps will provide the information needed to conduct a hazard analysis and complete a HACCP plan. The DoAg provides an example framework for a flow chart to Seaweed Producers for raw kelp:

Figure 3. Flow chart example for raw kelp production. This is a standard document generated by DoAg and should be tailored to a company's specific activities from cultivation to market, as necessary.



HACCP Plan, explanation of significant hazards and controls, and required documentation

The HACCP Plan outlines the critical control points, significant hazards, critical limits, corrective actions, verification and records necessary to maintain the highest quality of end product and to prevent potential illnesses, particularly since kelp is licensed as a raw agriculture product.

Figure 4. Standard HACCP plan template for raw kelp created by DoAg to assist first time applicants in navigating HACCP. This document can be modified through consultation with DoAg.

HACCP Plan Form

Firm Name: Firm Address:	Product Description: **Raw Kelp** Method of Storage and Distribution: **Raw Agriculture Commodity** Intended Use and Consumer:
Signature of Company Official:	Date:

(1) Critical Control Point	(2) Significant Hazards	(3) Critical Limits for each Preventive Measure	Monitoring				(8) Corrective Actions	(9) Verification	(10) Records
			(4) What	(5) How	(6) Frequency	(7) Who			
Harvest	Micro biological : Pathogens	Harvest only from areas on license under conditions specified.	Location of harvest areas listed on license.	Crosscheck GPS with license.	Before harvest on specified bed.	Harvester.	Update license/GPS coordinates.	HACCP licensee crosschecks records and signs weekly.	Log book – enter date, harvest area, start time, end time, species, amount.
	Chemical : Natural toxins	Harvest only from Approved or Conditionally Approved "open" waters.	Check if area open or closed.	Call the hotline.	Beginning of each day.	Harvester.	Return product to growing waters/recall.	HACCP licensee crosschecks records and signs weekly.	Log book – enter status and initial.
	Chemical : Contaminants		Historical pathogen and contaminant testing	Review prior year's results and coordinate sample submission with DoAg	Prior to harvest season.	Designee in conjunction with DoAg.	Consult with Consumer Protection and DPH.	Maintain test results on file. Review tests with DoAg, DPH, DCP.	Test results.
Label product	Micro biological : Pathogens Chemical : Natural toxins Chemical : Contaminants	Tag each container – include date, site, lot number, time exposed to air, time onto ice/into refrigeration.	Tag each container.	Visual.	Prior to leaving growing area	Harvester.	Retag if missing tag.	HACCP licensee crosschecks records and signs weekly.	Log book – enter and initial.
Transfer Point from Harvest boat to Dock	Micro biological : Pathogen growth	Ice/refrigerate day's harvest within 5 hours from harvest and 2 hours of reaching dock, whichever is shorter.	Check time from docking boat to time in refrigeration.	Record time of docking/ time to refrigeration.	Daily.	Harvester.	Divert to non-food use.	HACCP licensee crosschecks records and signs weekly	Log book – enter time boat docked and time into refrigeration. Initial.
Cooler storage	Micro biological : Pathogen growth	Cooler temperature <41°F.	Cooler temperature.	Thermometer.	Twice daily.	Harvester.	If cooler temp. is above 41°F for greater than 2 hrs, then product diverted to non-food use or considered for destruction.	HACCP licensee crosschecks cooler temp. log and signs weekly. Thermometer calibrated twice annually.	Cooler temperature and calibration log.
Transfer to purchaser.	Traceability.	All produce sold recorded for traceability.	Information of which lot of product is sold to which purchaser.	Record each lot and purchaser.	Each lot sold.	Company designee.	If not identified, divert to non-food use.	Review monitoring, corrective action, verification records within 1 week of preparation.	Record of date, lot, and customer.

Pathogens from the harvest area are a SIGNIFICANT biological hazard (Chapter 4 in the FDA Hazards Guide). The two controls are Source Control (primary processor) and temperature control (both primary and secondary processors). DoAg requires that seaweed production for human consumption be conducted in waters classified as Approved or Conditionally Approved (Open Status) for shellfish, which prohibits market harvest from waters that may be subjected to bacterial and viral contamination of animal or human fecal origin, from sources such as sewage and storm water. Once harvested, time/temperature control of the seaweed product will prevent the growth of pathogens to problematic levels and potential seasonal hazards associated with naturally occurring pathogenic bacteria. In the absence of time/temperature control, minimal levels of pathogens can multiply to levels that may increase the risk of foodborne illness in products consumed raw. For example, *Vibrio* sp.[1] will grow at temperatures that are 50°F or higher. Seaweed should be quickly placed under temperature control (ice or mechanical refrigeration) to maintain food safety upon harvest. Harvested seaweed must be placed under temperature control (ice*/gel packs** or mechanical refrigeration set at ≤ 41°F) within 5 hour of when harvest began or within 2 hours of reaching the dock, whichever is shorter.

- If ice is used to control temperature, a barrier should be used between the seaweed and the ice (e.g., plastic bag) to prevent fresh water ice melt from adversely affecting the quality of the seaweed. **If gel packs (clean and sanitized) are used as cooling media, a sufficient quantity should be used to ensure the seaweed is adequately chilled. There is additional information about critical adequate monitoring and corrective actions to avoid and address inadequate icing, respectively.
- HACCP recordkeeping requires producers to verify that critical limits for temperature are being maintained. A cooler storage log and calibration procedure has been provided that can be used for recording and verifying cooler temperatures or temperature control. Thermometer calibration is required twice a year for HACCP verification.

Figure 5. Figure 6. Thermometer calibration record provided by DoAg to assist Seaweed Producers maintain biannual calibration records.

Thermometer Calibration Record

Firm Name: _____

Firm Address: _____

The firm's thermometer probe(s) will be calibrated by placing the probe in a crushed ice / water slurry, stirring vigorously and reading/recording the temperature. This temperature should be 32° F, the melting point of ice. If the probe is not 32°F, the probe can be adjusted by using a wrench to rotate the screw under the backside of the dial to read 32° F when placed in the ice slurry. Next, place the probe in cooler for 3-5 minutes near the cooler thermometer, allowing time for probe to adjust. The temperatures of both are recorded and compared; any difference noted. The corrective action(s) must be recorded. These records must also be reviewed and verified. Thermometers shall be calibrated at least two times per year. If a temperature recording device is not able to be calibrated, dealer shall maintain the certificate that details the time period the recording device is considered accurate with calibration records and change out according to the manufactures recommendation.

Date				
Time				
Thermometer Name				
Temperature of probe when placed in the ice slurry				
+/- Adjustments made to the probe dial				
Difference between cooler thermometer and probe (+/-)				
Corrective action taken when cooler thermometer does not record the same temperature as probe when compared				
Employee Initials				
HACCP Review FULL Signature and date				

Figure 7. HACCP Cooler Storage Log provided by DoAg to assist Seaweed Producers.

HACCP Cooler Storage Log YEAR ________________

Company Name ____________________________________

Address _______________________ CT # _______________

Date	Harvest Area	Time harvest began	Time into Cooler and Initials	Cooler Temp IN	Time out of Cooler	Cooler Temp OUT

HACCP Review Signature ________________________ Date ________

HACCP Review Signature ________________________ Date ________

The US FDA has not established federal microbiological limits for seaweed. At the request of DoAg, samples are collected prior to harvest in the spring, and delivered to the Department of Public Health for microbiological testing (*Vibrio*, *Salmonella*, *E.coli* O157:H7 and *Shigella, Norovirus,* and Hepatitis A). Limits and reference levels have been established by DoAg (Table 1).

Table 1. DoAg limits and reference levels for microbial parameters for seaweed as a raw agricultural commodity.

Parameter	Units	Reference Level/Tolerance Level	Source
Microbiological Food Testing			
Salmonella Screen	NA	ND	Code of Federal Regulations Title 21 Part 117
E. coli O157:H7	NA	ND	Code of Federal Regulations Title 21 Part 117
Listeria Screen	NA	ND	Code of Federal Regulations Title 21 Part 117
Shigella	NA	ND	Code of Federal Regulations Title 21 Part 117
Total Coliform	MPN/mL	Screening indicator	Code of Federal Regulations Title 21 Part 117
Fecal Coliform	MPN/mL	Screening indicator	Code of Federal Regulations Title 21 Part 117

Environmental contaminants (PCBs, heavy metals, pesticides) are SIGNIFICANT chemical hazards (Chapter 9 in the FDA Hazards Guide) because certain seaweed species exhibit a high affinity for accumulating heavy metals and other contaminants in their tissues (e.g. Shaughnessy et al. 2023). While these contaminants are generally not associated with food-borne illness outbreaks, they can cause health risks such as carcinogenic and mutagenic effects that are associated with long-term exposure. Three relevant control strategies from Chapter 9 that could serve as models are Results of testing and monitoring (primary processor), Chemical contaminant testing (primary processor) and Source control (primary and secondary processors).

The US FDA has not established federal heavy metal, pesticide, or PCB limits for seaweed. The DoAg has adopted the available food standard codes for heavy metals, pesticides, and PCBs in seaweed (Table 2). Please note there are emerging contaminants that seaweed have never been tested for in Connecticut, such as Per- and Polyfluoroalkyl Substances (PFAS). At the request of DoAg, samples are collected prior to harvest in the spring, and delivered to the Connecticut Agricultural Experiment Station for heavy metal, pesticide, and PCB testing.

Table 2. DoAg limits and reference levels for heavy metals, pesticide residues, and PCBs for seaweed as a raw agricultural commodity.

Parameter	Units	Recommended Limit	Source
Arsenic (As, inorganic)	mg/kg dry weight	<3.0	French Agency for Food, Environmental and Occupational Health & Safety
Lead (Pb)	mg/kg dry weight	<5.0	French Agency for Food, Environmental and Occupational Health & Safety
Cadmium (Cd)	mg/kg dry weight	<0.5	French Agency for Food, Environmental and Occupational Health & Safety
Mercury (Hg)	mg/kg dry weight	<0.1	French Agency for Food, Environmental and Occupational Health & Safety
Iodine (I)	mg/kg dry weight	<2000.0	French Agency for Food, Environmental and Occupational Health & Safety
Pesticide Chemical Residues	ppm	ND	Title 40: Protection of Environment PART 180—TOLERANCES AND EXEMPTIONS FOR PESTICIDE CHEMICAL RESIDUES IN FOOD Subpart C-Specific Tolerances
Total PCBs	ppm	ND	Code of Federal Regulations Title 21 Part 109.30

Other countries and other states in the U.S. have reported food-borne disease outbreaks associated with naturally occurring seaweed toxins, including outbreaks related to the consumption of several *Gracilaria* species[2]. These toxins are often heat-stable, meaning that the toxin can persist even if seaweed is cooked sufficiently. These toxins have the ability to cause severe illness or even death. Although unlikely to cause illness from sugar kelp consumption, DoAg maintains harmful algal bloom (HAB) and shellfish toxin monitoring programs and closes impacted shellfish growing areas to protect public health. Such closures would prevent harvesting of potentially contaminated seaweed products. There is a higher risk associated with *Gracilaria* cultivation, which is not grown in Long Island Sound waters (Chapter 6 in the FDA Hazards Guide).

In accordance with the requirements for packaging raw kelp, reduced atmosphere packaging is prohibited. Spores of the pathogenic bacteria, *Clostridium botulinum*, are naturally occurring in the marine and estuarine environment. It is a spore-forming bacteria that requires anaerobic (oxygen free) conditions to grow (reduced oxygen packaging, for example). This hazard (Chapter 13 in the FDA Hazards Guide) could be considered potentially SIGNIFICANT for seaweed products that are packed in reduced atmosphere package (e.g., vacuum packed). Typically multiple controls or barriers are required to prevent the formation of the *C. botulinum* toxin. Control strategies included in Chapter 13 that could serve as relevant models include Refrigeration with time temperature controls or Frozen with labeling.

Seaweed, itself, is not considered an allergen. However, seaweed cultivated on longlines in Long Island Sound could be exposed to fouling organisms, including crustacean shellfish, one of the top eight allergens *(Chapter 19 in the FDA Hazards Guide)*. Fouling crustaceans may contain the protein tropomyosin, which is known to cause ingestion-related allergic reactions; this potential "hidden" crustacean shellfish allergen hazard could be present in raw or processed seaweed products (Motoyama et. al 2007). For this reason, the crustacean shellfish allergen is considered a potentially SIGNIFICANT chemical hazard for seaweed.

Harvest Log

The DoAg has created a harvest log to aid Seaweed Producers in tracking kelp harvest and sales, and time to temperature requirements to prevent post-harvest bacteria growth. Seaweed Producers are required to keep a harvest log and meet time to temperature requirements. The harvest log shall record the disposition of all product harvested that day. Regulatory authorities must be able to trace all product through the distribution chain in the event of an illness. The ability to implement large recalls does not negate the importance of maintaining precise traceability for each date of harvest.

Harvest Log HarvestLog2018

Company Name_____CT #_____

Address_____ Vessel Name_____ Year_____

Date														
Start Harvest														
End Harvest														
Conditional Harvest Area Checked and Status (circle)														
	OPEN/CLOSED		OPEN/CLOSED		OPEN/CLOSED		OPEN/CLOSED		OPEN/CLOSED		OPEN/CLOSED		OPEN/CLOSED	
Approved Harvest Area Checked and Status (circle)														
	OPEN/CLOSED		OPEN/CLOSED		OPEN/CLOSED		OPEN/CLOSED		OPEN/CLOSED		OPEN/CLOSED		OPEN/CLOSED	
Species														
# Bags														
Time Arrived at Dock														
	Sold To	Time Sold	Sold To	Time Sold	Sold To	Time Sold	Sold To	Time Sold	Sold To	Time Sold	Sold To	Time Sold	Sold To	Time Sold
Sold to Whom														
Time Refrigerated														
Name of Boat Capt. And Initials Daily														

Weekly Review by: (Full Signature Required) _____ Date:

Sanitation Standard Operating Procedures

The DoAg created a standard SSOP form that is provided to all Seaweed Producers. These procedures address the relevant eight key sanitation conditions or areas called out in the 2022 FDA seafood regulation, and are important to avoid post-harvest contamination. As a reminder, these are:

1. Safety of water
2. Condition and cleanliness of food contact surfaces
3. Prevention of cross-contamination
4. Maintenance of hand washing, hand sanitizing and toilet facilities
5. Protection from adulterants
6. Labeling, storage and use of toxic compounds
7. Employee health conditions
8. Exclusion of pests

License holders are responsible for completing the form daily.

Figure 8. Daily Sanitation Audit Form developed by DoAg for raw seaweed producers.

DAILY SANITATION AUDIT FORM – Aquaculture Seaweed Producer

Firm Name: _____ YEAR:_____

Firm Address: _____

Enter Date of entry----------→ **Enter Time of entry----------→**	_/_	_/_	_/_	_/_	_/_	_/_	_/_
SAFETY OF WATER: approved water supply, check for backflow devices							
CONDITION/CLEANLINESS OF FOOD CONTACT SURFACES: Ice shovels, Ice scoop, bins, ice machines, and shellfish contact surfaces Cleaned, sanitized, good condition, properly stored							
Concentration of Sanitizer (Record Amount) Chlorine 100-200 ppm, Iodine 25 ppm, Quaternary Ammonia 200 ppm Test Kits provided and used to check solution.							
PREVENTION OF CROSS CONTAMINATION: Product is protected from splash, condensate drip, not stored below raw food							
Product not directly in contact with floor of cooler. Product separated by lot							
Personal items not stored in processing area. No eating or tobacco use in processing area							
Employee hands are washed after any breaks from work							
MAINTENANCE OF HAND-WASHING, HAND-SANITIZING, AND TOILET FACILITIES: Toilet and Hand-washing facilities are checked for cleanliness, supplies and warm water							
PROTECTION FROM ADULTERANTS: Light fixtures shielded, product protected during transfer							
PROPER LABELING, STORAGE AND USE OF TOXIC COMPOUNDS: Cleaning supplies stored properly and away from product							
All supplies labeled to identify contents and intended use							
CONTROL OF EMPLOYEES WITH ADVERSE HEALTH CONDITIONS: Employees with unhealthy conditions are reassigned to other duties							
EXCLUSION OF PESTS: There are no pest, rodents, insects, etc., in area							
Initial entry when checked ----------→							

Please note below any corrections that had to be made to the above listed items

In addition to specific storage requirements for sanitation supplies to prevent potential contamination of food products, there are specific sanitation requirements for food contact surfaces and other surfaces, as outlined below:

SANITIZING

- After food contact surfaces are cleaned, they must be sanitized to eliminate harmful organisms
- Sanitizers must be approved for use in food service operations
- Most commonly used sanitizers are chlorine and quaternary ammonium
- Sanitizers must be mixed and applied according to directions
- For food contact surfaces, the recommended concentration is 100 to 200 ppm (parts per million) for chlorine and 200 ppm for quaternary ammonium
- Concentration must be tested using the appropriate test strip
- Both sanitizers and test strips are available from restaurant supply companies
- The procedure for sanitizing surfaces is to first rinse the surface well with water, then use a food service approved detergent for cleaning, rinse detergent well, then apply sanitizer and allow to air dry

Volumes for mixing chlorine sanitizing solution with a 5.25% bleach*

Surface	Concentration (ppm)	Volume Water	Chlorine
Hand dip	50	1 gallon	¼ Tablespoon
Food Contact	200	1 gallon	1 Tablespoon
Food Equipment	200	1 gallon	1 Tablespoon
Floors and Walls	2400	1 gallon	¾ Cup

*Concentration must be tested using the appropriate test strip

Harvest Boats

- Although there are no "food contact surfaces" on a boat, it is recommended that cull table, pallets, baskets, and sorters are cleaned and sanitized before harvesting shellfish
- Equipment surfaces may become contaminated by bird or rodent dropping, or microorganisms in sediments, and should be sanitized prior to harvest and as needed during the day
- Knowing the concentration of sanitizers is critical, as too high a concentration creates a toxic environment, and too low a concentration will be ineffective at killing microorganisms
- For shellfish processing equipment: use the concentrations given above for food contact surfaces (100 to 200 ppm for chlorine and 200 ppm for quaternary ammonium)

Recall Procedures

The DoAg provides a Recall Procedure to all Seaweed Producers; this document is required because food products, especially those sold as raw commodities, have the potential to cause human illness. Recordkeeping is essential to ensure that product(s) implicated in human illnesses can be traced back to a company/growing area, and any remaining product in the market is immediately recalled and destroyed to prevent additional illnesses. Any company inventory associated with the illness investigation shall be destroyed. In addition, DoAg developed a recall notification list to track that all purchasers are notified of the recall.

CT State Department of Agriculture Bureau of Aquaculture (DA/BA) Licensed Aquaculture Producers
RECALL PROCEDURES

Producer Name: _____Certification Number: CT_____
Signature of Responsible Party Adopting this Procedure:_____

This recall procedure is to be kept on file by your company in an easily-accessible location. Should the DA/BA or a Producer (Firm) initiate a recall of seaweed product because of public health concerns, the DA/BA will monitor the progress and success of the recall. The DA/BA will immediately notify the Food and Drug Administration (FDA) and the Authorities in other states if products involved in the recall have been distributed outside of CT. Each Authority involved in a recall will implement actions to ensure removal of recalled product from the market and issue public warnings if necessary to protect public health. The FDA will decide whether to audit or issue public warnings after consultation with the DA/BA and/or other Authorities and after taking into account the scope of the product distribution and other related factors. If the FDA determines that the Authority in any state involved in the recall fails to implement effective actions to protect public health, the FDA may classify, publish and audit the recall, including issuance of public warnings when appropriate.

The DA/BA will monitor the progress and success of all recalls within CT. Should there be a need to initiate a recall either by direction of the DA/BA or by a licensed seaweed producer, you are required to adhere to the following:

1) Promptly follow the directions of the DA/BA in reacting to a recall and/or promptly notify the DA/BA by telephone when any situations come to your attention which could warrant initiating a recall. These situations could be any reports of illness, biotoxin closures, sewage spills, petroleum products spills, etc.

2) Once informed that a DA/BA directed recall or a Firm-initiated recall is implemented promptly contact each of your customers by telephone or in person and notify them about the recall. Direct your customers to stop all sales and secure any products involved in the recall that may still be on hand.

3) Properly identify each bag/container of seaweed involved in the recall with an On-Hold for Recall placard or marker with date and separate them from other products not involved in the recall. These recall products must be properly secured.

5) Request that your customers report back to you as soon as possible, but no later than 24 hours, where the recalled products were distributed and whether your customers still have any product on hand. Maintain an accurate Recall Account Summary Report of products sold to each of your customers and the current disposition of the products:

i) Amount sold to each customer during the recall period
ii) Amount still on hand at your facility
iii) Amount still on hand at each of your customers facilities
iv) Amount already sold and consumed and not returnable by each of your customers

1. If there is recalled product, you will instruct your customers to return the product to you for proper securing of it in your facility or to hold it in a separate location at their facility and clearly mark it as not for sale and wait for final disposition instructions.

2. You will promptly notify the DA/BA as to where the entire recalled product is located. You will coordinate with the DA/BA or the local health jurisdiction in your area to witness destruction of the product. If required, all product returned to you will be destroyed in the presence of a witness from the DA/BA or a local or state health jurisdiction. You will provide a Recall Account Summary Report of the recalled product to the DA/BA within 48 hours.

3. A list of your current direct customers and their telephone numbers will be maintained in your records for recall notification.

The DA/BA contact telephone numbers for recall notification purposes are 203-874-0696 during business hours and 203-209-4023 during non-business hours.
The following customer notification list is for your use in contacting your customers.

RECALL CUSTOMER NOTIFICATION LIST

Seaweed Customer	Manager or Contact Person	Phone Number

Raw Agricultural Commodity Flow Chart

Description: A seaweed species, in its raw, whole and unprocessed form, sold by the agricultural unit, not by weight or volume (i.e. sold by the blade), and in an unsealed bag or box.

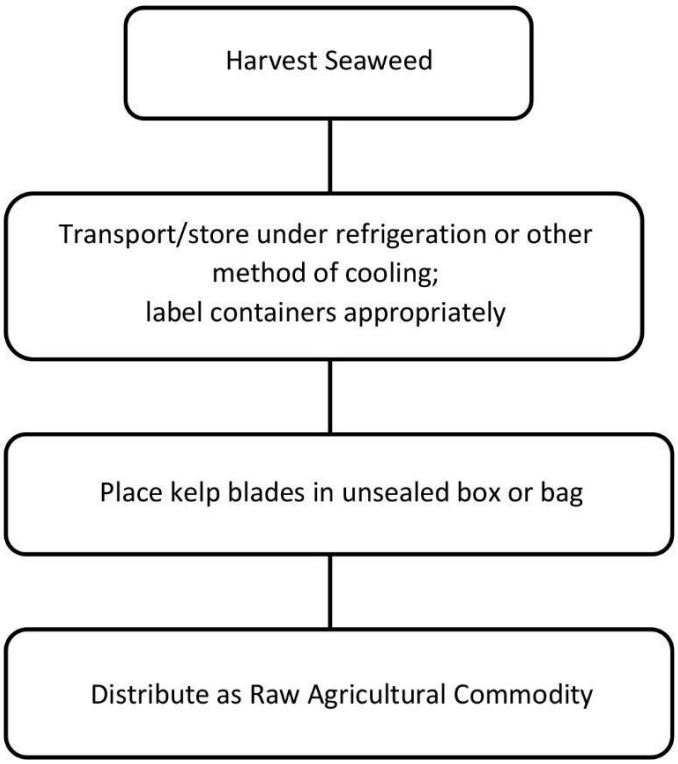


Figure 9. Example process flow diagram for seaweed as a Raw Agricultural Commodity

References

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Motoyama, K., Hamada, Y., Nagashima, Y. and Shiomi, K. 2007. Allergencity and allergens of amphipods found in nori (dried laver). Food Additives and Contaminants. 24(9): 917-922.

Shaughnessy B.K., Jackson B.P., Byrnes J.E.K. 2023. Evidence of elevated heavy metals concentrations in wild and farmed sugar kelp (*Saccharina latissimi*) in New England. Nature. 13: 17644.

Footnotes

[1]*Vibrio* bacteria are naturally occurring in the marine and estuarine environment, and if present will multiply to harmful levels in the growing area or post-harvest under the right conditions. Outbreaks of food-borne disease associated with *Vibrio parahaemolyticus* contamination of seaweed have occurred in Japan, and along with *V. vulnificus*, is the topic of active research in Japan and elsewhere. Both *V. parahaemolyticus* and *V. vulnificus* have been isolated from seaweeds in Japan with the recommendation that seaweed not be consumed during the summer months in Japan, due to contamination by *V. vulnificus*.

Food-borne disease outbreaks of *V. parahaemolyticus* have occurred in association with oysters and clams harvested in New York and Connecticut waters. Due to these findings and under current environmental conditions, continued efforts to monitor the presence or absence of *Vibrio* in cultivated seaweed species must be conducted to determine whether or not specific pathogens from the harvest area are considered a significant hazard.

[2]Outbreak of Gastrointestinal Illness Associated with Consumption of Seaweed-Hawaii, 1994. Centers for Disease Control Morbidity and Mortality Weekly Report, 44(39): 724-7. Downloaded on 12/11/12.

Contact Information for Relevant State Regulatory Agencies

Connecticut Department of Agriculture, Bureau of Aquaculture
P.O. Box 97, Milford, CT 06460
(203) 874-0696 / fax (203) 783-9976
Agri.Aquaculture@ct.gov

Connecticut Department of Consumer Protection, Food and Standards Division
450 Columbus Blvd., Suite 901, Hartford, CT 06103
(860) 713-6160
dcp.foodandstandards@ct.gov

Emily Herz, Environmental Analyst
Land and Water Resources Division-West Regulatory
Connecticut Department of Energy & Environmental Protection
Emily.herz@ct.gov 869-424-3455

Contact Information for Seafood HACCP Training and Extension Services

Nancy Balcom
Seafood Safety/HACCP training courses
Connecticut Sea Grant/UConn Extension
1080 Shennecossett Road, Groton, CT 06340
(860) 405-9107
nancy.balcom@uconn.edu

Other Resources

CFR Title 21 Part 117 - Current Good Manufacturing Practice, Hazard Analysis, and Risk-based Preventive Controls for Human Food

CFR Title 21 Part 109.30 - Tolerances for polychlorinated biphenyls (PCB's)

Title 40: Protection of Environment - PART 180—TOLERANCES AND EXEMPTIONS FOR PESTICIDE CHEMICAL RESIDUES IN FOOD Subpart C-Specific Tolerances

French Agency for Food, Environmental and Occupational Health & Safety on the risk of excess iodine intake from the consumption of seaweed in foodstuffs