

POLICY BRIEF

Seaweed as a Natural Solution to Global Iodine Deficiency

Harnessing the World's Richest
Natural Iodine Source for Public
Health



P O L I C Y B R I E F

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Prepared by

The Global Seaweed Coalition & The International Seaweed Association

Based on the outcomes of three expert Working Groups (March 2026)
and the Kick-off Workshop (November 2025)

Executive Summary

Iodine deficiency remains one of the most widespread micronutrient deficiencies worldwide, affecting over two billion people and constituting the leading preventable cause of cognitive impairment globally. While universal salt iodization (USI) remains the World Health Organization (WHO)-preferred strategy, one-third of households globally still lack access to adequately iodized salt, and sodium-reduction public health campaigns are simultaneously eroding this primary delivery mechanism. Complementary, accessible iodine sources are urgently needed.

Seaweed is the richest natural source of iodine on the planet, with concentrations in brown species reaching several thousand milligrams per kilogram of dry weight—orders of magnitude above iodized salt or fish. Countries with longstanding seaweed-based diets, notably Japan, maintain adequate iodine status without iodized salt. Yet seaweed remains largely unrecognized in global nutrition policy due to variability in iodine content across species, concerns over excess intake, deeply fragmented regulation, and critical gaps in the scientific evidence base.

This policy brief synthesizes the findings of two workshops and three expert Working Groups convened in March 2026 by the Global Seaweed Coalition (GSC) and the International Seaweed Association (ISA), from November 2025 through June 2026, bringing together scientists, regulators, industry representatives, and public health experts from over a dozen countries. It presents eight actionable policy recommendations designed to position seaweed as a safe, standardized, and scalable complementary source of iodine for public health—without replacing salt iodization.

Key Findings at a Glance

(1) Seaweed iodine is highly bioaccessible and may offer a more sustained release than iodized salt. (2) Blanching and other processing methods can reliably reduce iodine content to safe ranges. (3) Regulatory approaches differ dramatically worldwide, from near-total prohibition (Germany: 20 mg/kg) to nutritional guidance only (Japan: 3,000 µg/day UL). (4) Species-level distinctions are essential: brown seaweeds are iodine-rich; red and green species contain far less. (5) Risk-benefit analyses are insufficient and skewed toward risk of excess consumption, overlooking widespread deficiency. (6) Human intervention studies are critically lacking. (7) Vulnerable populations—pregnant and lactating women, infants, and adolescents—face disproportionate risk from both deficiency and excess and require targeted guidance. (8) Southeast Asia and sub-Saharan Africa carry the highest deficiency burden yet are the most underrepresented in research.

This policy brief does not propose replacing universal salt iodization or removing safety assessments and regulatory oversight. It rather advocates for a balanced risk-benefit assessment, evidence-based complementary strategies, species-specific regulations and processing and labeling solutions.

1. The Iodine Challenge: the cost of inaction

Despite decades of progress through salt iodization programs, iodine deficiency remains one of the world's most widespread micronutrient deficiencies, affecting an estimated two billion

people globally. The consequences of inadequate iodine intake extend far beyond thyroid health issues and represent a significant but often under-recognized public health burden.

Data from Wu et al. (2024) show that iodine deficiency is most severe in Southeast Asia, with the largest increase in prevalence between 1990 and 2019 recorded in East Asia. Women have a higher global prevalence of iodine insufficiency than men. While high-income North America shows minimal deficiency, many European, African, and Asian countries face persistent or re-emerging gaps—driven by dietary shifts toward plant-based diets with reduced dairy consumption, lower use of iodized salt, and declining iodine content in processed foods. Additionally, in countries like the UK, the iodine content of dairy products is declining - therefore typical or historic sources of iodine may no longer be viable in the future due to changes in farming and feed practices.

Iodine is essential for thyroid hormone production, which regulates metabolism, brain development, and growth. Severe deficiency during pregnancy and early childhood can cause irreversible cognitive impairment. At the population level, iodine deficiency disorders (IDD) represent one of the largest preventable causes of intellectual disability worldwide. Collectively, these effects translate into substantial societal and economic costs through reduced human potential, educational outcomes, and workforce productivity.

Recognizing the risk of iodine deficiency and its prevalence in many countries, iodized salt is encouraged as a fortification tool. It is variably available: in countries like the United Kingdom, iodized salt is difficult to find; in others like South Africa, food manufacturers are not required to use iodized salt despite its ready availability.

Simultaneously, public health campaigns to reduce sodium intake as part of cardiovascular disease prevention strategies may inadvertently reduce iodine intake in populations where iodized salt is the primary iodine source. Furthermore, access to iodized salt remains uneven globally, and dietary transitions may further reduce iodine intake in some regions and demographic groups.

Current regulatory discussions around seaweed have largely focused on risks associated with excessive iodine intake, particularly from certain brown seaweed species. The Wolff–Chaikoff effect—a physiological mechanism by which the thyroid temporarily halts hormone production in response to acute high iodine intake—provides protection in healthy adults. However, this mechanism is not fully developed before approximately four years of age, and chronic excessive intake can overwhelm it, especially in individuals with pre-existing thyroid conditions or those transitioning from low- to high-iodine diets. While these concerns are important and must be addressed, the risks associated with continued iodine deficiency and limited dietary diversification should also be considered. A precautionary approach that focuses solely on avoidance may unintentionally overlook opportunities to improve iodine nutrition through controlled, evidence-based use of seaweed.

The cost of inaction is therefore not neutral. Failing to explore safe and standardized pathways for integrating seaweed into food systems may mean missing an opportunity to complement existing iodine strategies, strengthen nutritional resilience, and address persistent micronutrient deficiencies in a sustainable way.

A note on vulnerable populations: The consequences of iodine deficiency are not uniform across population groups. Particular attention should be given to vulnerable population groups, including pregnant and lactating women, infants, young children, and individuals with

pre-existing thyroid disorders. These groups may be more sensitive both to iodine deficiency and to excessive iodine intake. Pregnant and lactating women require approximately 50% more iodine than the general adult population (250 µg/day vs. 150 µg/day). Infants and young children are highly susceptible to neurodevelopmental harm from deficiency, as are adolescents during growth spurts. Conversely, these same groups—particularly pregnant women and those with pre-existing thyroid conditions—may be more sensitive to iodine excess. Any complementary iodine strategy must therefore provide specific, tailored guidance for vulnerable groups.

2. Seaweed as a Complementary Iodine Source

2.1 Unmatched Iodine Concentration

Seaweed is by far the most concentrated natural source of iodine. Brown seaweeds — kelps such as *Saccharina* and *Laminaria*, wakame (*Undaria pinnatifida*), and bladderwrack (*Fucus vesiculosus*)—contain iodine concentrations of 2,000–8,000 mg/kg dry weight, compared to 13–20 mg/kg in iodized salt and approximately 2.5 mg/kg in fish. Even species considered relatively low in iodine, such as nori (*Pyropia*, *Neopyropia*, and *Porphyra*) contain around 100 parts per million, still substantially higher than most other foods.

Still, seaweeds can be consumed in different forms in various culinary products, such as snacks, powders, and supplements, with iodine concentrations varying substantially across products. This variability is simultaneously one of seaweed’s greatest assets (it can cover iodine needs in tiny quantities) and its principal regulatory challenge.

2.2 Bioavailability and Absorption

Research on iodine speciation shows that inorganic iodide is the predominant form in all seaweeds tested, constituting 65–100% of total iodine species, and is readily bioaccessible. Human studies comparing seaweed-derived iodine with potassium iodide (KI) supplements show that while KI produces a sharp absorption spike, seaweed releases iodine more gradually over a longer period—a potentially advantageous “matrix effect” that avoids sudden peaks in iodine exposure. Emerging evidence also suggests that within brown seaweeds, the *Alariaceae* family (including wakame) contains more organically bound iodine than the *Laminariaceae* (including kombu), with implications for differential bioavailability across species. Minor organic iodine compounds (including moniodotyrosine and diiodotyrosine) and additional unidentified iodine species have also been detected in red and green seaweeds.

2.3 Processing Reduces Iodine to Safe Ranges

Processing methods—particularly blanching at 80°C for 20–120 seconds—can reliably reduce iodine content in brown seaweeds to levels compliant with both the current French recommendation (2,000 mg I/kg dry weight) and the proposed European Food Safety Authority (EFSA) threshold (1,000 mg I/kg dry weight). Regardless of the starting concentration, blanching reduces iodine to a similar baseline, suggesting a residual fraction that remains bound to the biomass. Other methods (sun-drying, oven-drying, fermentation) have more variable and generally lesser effects. The Food and Agriculture Organization (FAO)/WHO expert meeting on food safety for seaweed in 2022 catalogued a broad range of processing methods that affect iodine concentration, and the European Commission has proposed that thresholds should apply to the product as sold, not to freshly harvested biomass.

2.4 The Japanese Precedent

Japan provides compelling evidence that seaweed-based diets can sustain population-level iodine adequacy. Japanese populations consume seaweed daily in multiple forms, often at iodine intakes exceeding those that would trigger concern under other regulatory frameworks. Yet thyroid disease rates in Japan are not elevated; iodine deficiency is virtually absent. A nationwide study of over 32,000 schoolchildren confirmed overall adequate iodine status, although with regional variation and some areas of excess intake. Research suggests that habitual high iodine exposure induces adaptive thyroid regulation (the Wolff-Chaikoff effect and subsequent escape), and that regular consumption provides a degree of homeostatic resilience absent in populations with fluctuating iodine intake.

The Japanese experience demonstrates that seaweed can contribute substantially to iodine nutrition within a long-established dietary culture. However, this context includes lifelong exposure, species-specific preparation practices, moderate portion sizes, and broader dietary patterns that may not be directly transferable to other populations. The Japanese case should therefore be viewed as an important learning example rather than a universal template.

2.5 Sustainability and Co-Benefits

Seaweed cultivation requires no arable land, freshwater, or fertilizer. It provides several ecosystem services and contributes to coastal livelihoods—directly supporting multiple Sustainable Development Goals. An estimated 30 million or more smallholders worldwide are engaged in the seaweed value chain. Brown seaweeds also contain omega-3 fatty acids, minerals, vitamins, polyphenols, and carotenoids, making them broadly nutritious, not just sources of iodine. Positioning seaweed as a recognized nutritional intervention would strengthen the economic and environmental case for its sustainable expansion. A policy framework that positions seaweed only through an iodine-safety lens misses its full potential.

In addition, plant-based diets are being actively promoted globally in the context of sustainability and environmental goals, and this dietary shift may therefore increase reliance on plant-derived iodine sources such as seaweed.

3. Barriers to Seaweed as a Policy Tool

3.1 Fragmented and Inconsistent Regulation

Seaweed is not consistently recommended as a routine iodine source in most dietary recommendations. Where mentioned, it is usually accompanied by caution due to risk of excess intake. The regulatory landscape for iodine in seaweed is highly fragmented and, in several cases, internally inconsistent. National maximum limits vary by two orders of magnitude, and in the absence of a Codex Alimentarius standard, national agencies have set thresholds based on domestic considerations that often disregard the latest scientific evidence. The table below illustrates the regulatory fragmentation:

Table 1: Comparative regulatory landscape for iodine and seaweed (source: Working Group 1, March 2026)

Country/Region	Adequate Intake (adults)	Upper Limit (adults)	Seaweed Iodine Threshold	Notes
WHO/FAO	150 µg/day	Not set	Not set	Reference framework; no seaweed-specific limit
United States	150 µg/day	1,100 µg/day	None	No mandatory iodine labeling; National Institutes of Health (NIH) lists seaweed as dietary source
EU	150 µg/day	600 µg/day	Proposed 1,000 mg/kg	Under discussion at DG SANTÉ; no formal EU-wide limit adopted yet
France	150 µg/day	600 µg/day	2,000 mg/kg (ANSES)	Agence nationale de sécurité sanitaire (ANSES) does not endorse seaweed for correcting deficiency
Germany	150 µg/day	600 µg/day	20 mg/kg	Effectively excludes almost all seaweed species
Australia / NZ	150 µg/day	1,100 µg/day	1,000 mg/kg (imports only)	No regulation for domestic seaweed → 50% of global seaweed recalls
Canada	150 µg/day	1,100 µg/day	None specific	Iodine recently allowed as supplemental food ingredient
Japan	130 µg/day	3,000 µg/day	None	Nutritional guidance only; routine seaweed consumption not restricted
China	150 µg/day	Not set	None	Guidance on serving sizes; primary sources are iodized salt and seafood
South Africa	150 µg/day	Not reported	None	Iodized salt primary source; deficiency persists in pregnant women

These inconsistencies create trade barriers, consumer confusion, and regulatory uncertainty for producers. Germany's threshold of 20 mg/kg effectively bans virtually all commercially available seaweed species. A proposed EU-wide threshold of 1,000 mg/kg, if applied uniformly, would trigger widespread product rejections within Europe. Australia's regulation of imported but not domestic seaweed creates an uneven playing field. The absence of a Codex Alimentarius standard for iodine in seaweed is a critical gap that enables this fragmentation to persist; developing such a standard should be a priority for the international community.

3.2 Insufficient Evidence Base

While analytical chemistry and in vitro data are abundant, human intervention studies on iodine absorption, metabolism, and excretion from seaweed-based diets are critically lacking. Most in vitro bioaccessibility studies do not follow the standardized international Infogest protocol, making cross-study comparison unreliable. Geographic data gaps are severe; almost no published research exists on iodine content in the seaweed species commonly consumed in Southeast Asia, the region with the highest iodine deficiency burden. The mechanisms by which Japanese and other populations with high seaweed consumption avoid iodine toxicity remain poorly understood.

Equally important is the near-total absence of studies specifically examining iodine from seaweed in vulnerable populations: pregnant and lactating women, infants, individuals with thyroid disease, and adolescents. These groups are most affected by both deficiency and excess, yet are systematically excluded from existing studies for ethical reasons that need not preclude well-designed observational or intervention research with appropriate safeguards.

3.3 Absence of Labeling Requirements

Consumers and regulators face difficulties in understanding and managing potentially very high iodine exposures. Standard labeling of iodine may support consumers in making informed choices. No jurisdiction currently mandates iodine content disclosure on seaweed product labels. Commercial products often state only “seaweed” without species identification, and nutritional profiles rarely include iodine. This creates risks for consumers who need iodine (the deficient majority) and for those who must limit their intake (individuals with thyroid conditions). Without reliable labeling, safety assessments for seaweed-containing products remain difficult.

3.4 Skewed Risk-Benefit Assessment

Existing regulatory approaches have primarily focused on managing risks associated with excess iodine intake, while less attention has been given to evaluating the public health implications of continued iodine deficiency. Recent European risk–benefit assessments indicate that moderate incorporation of seaweed-based foods may substantially improve iodine intake without exceeding current upper intake levels in modeled adult populations, demonstrating the feasibility of using seaweed within controlled dietary strategies. Yet, many risk-benefit analyses of seaweed consumption lean heavily toward risk and give insufficient weight to the nutritional benefits of seaweed, which include not only iodine but also fatty acids, minerals, vitamins, polyphenols, and carotenoids.

Some regulatory agencies have tended to prioritize safety over benefit, potentially overlooking the net positive effects of moderate seaweed consumption in the context of widespread global iodine deficiency. No comprehensive Disability-Adjusted Life Year (DALY)-based risk-benefit analysis of iodine from seaweed currently exists. Such an analysis—stratified by population group, region, and consumption scenario—would transform the quality of evidence available to policy-makers.

3.5 Global South Research and Policy Gap

A profound asymmetry exists between where the iodine deficiency burden lies and where seaweed research and policy development is concentrated. Southeast Asia, sub-Saharan Africa, and parts of South Asia bear the brunt of global iodine deficiency, yet are nearly absent from the seaweed nutrition literature. Seaweed is widely consumed in these regions—

particularly in Southeast Asia, where diverse marine algae are integral to traditional diets—but iodine content data for locally consumed species are almost entirely lacking. Policy frameworks developed in Europe or North America may be poorly suited to the species, preparation methods, and dietary contexts of these regions. A genuinely global evidence base is a prerequisite for a better policy.

4. Policy Recommendations

Drawing on the collective expertise of the workshops and working groups, the following eight recommendations are proposed for consideration by national governments, international organizations, regulatory bodies, and the UN Global Seaweed Initiative.

Recommendation 1: Adopt a Risk-Benefit Framework for Iodine in Seaweed

Regulatory approaches to iodine in seaweed should move beyond a focus on maximum safety levels and formally adopt a risk-benefit framework that accounts for both the risks of excess intake and the well-documented global shortfall in adequate iodine intake. Risk-benefit analyses should be quantified using DALYs, stratified by gender, age group, vulnerability status, and region, and should incorporate the full spectrum of seaweeds' nutritional benefits. The precedent of DALY-based analysis for folic acid fortification provides a proven methodological model. Regulatory decisions should explicitly weigh the public health cost of continued iodine deficiency against the population-level risks of occasional excess intake.

Recommendation 2: Regulate Seaweed Products as Consumed, Not as Raw Ingredients

Iodine thresholds for seaweed should apply to the product as sold and as typically prepared by consumers, not to freshly harvested or dried biomass. Processing methods such as blanching can reliably reduce iodine content by 50–80%, and traditional preparation methods (soaking, boiling, cooking) further lower concentration and thereby also exposure. One should also consider the type of product that includes seaweed and the possible intake levels per day. Risk depends on exposure, not concentration alone. Regulation based on raw-material concentration fails to reflect actual consumer exposure and penalizes species that are nutritionally and ecologically valuable. The European Commission's proposal to set thresholds on the product as sold should be adopted internationally as a regulatory principle.

Recommendation 3: Establish Mandatory Species-Level Differentiation in Regulation

Regulations and public health communications should clearly distinguish between seaweed species groups based on their iodine profiles. Brown seaweeds (kelps and fucoids) contain dramatically higher iodine levels than red and green species, in which iodine is virtually undetectable in some cases. A one-size-fits-all regulatory approach that applies the same threshold to nori (low iodine) and kombu (high iodine) is

scientifically unjustified, commercially harmful, and confusing for consumers. Species-group-specific thresholds and guidance would allow proportionate regulation while supporting consumer choice.

Recommendation 4: Mandate Iodine Content Labeling for Seaweed Products

All food products containing seaweed as a primary ingredient should be required to disclose: (a) the species (or blend of species) present; (b) the iodine content per serving and per 100g, measured using standardized analytical methods; and (c) the contribution to the recommended nutrient intake as a percentage. Where feasible, labels should indicate expected iodine content after typical preparation (e.g. after blanching or soaking), not only for the dry product. Iodine labeling serves both populations who are deficient (allowing them to identify good dietary sources) and those who need to limit intake (enabling informed choices). Given that iodine content varies significantly with origin, season, and batch, disclosure requirements should specify analytical testing frequency and tolerances. Standardized reference methods for iodine analysis in seaweed products should be established internationally, with guidance from Codex Alimentarius.

Recommendation 5: Develop Targeted Guidance for Vulnerable Populations

Dedicated guidance on seaweed consumption for iodine should be developed for vulnerable population groups, particularly: (a) pregnant and lactating women, who have elevated iodine requirements and for whom both deficiency and excess carry specific risks; (b) infants and young children, including guidance for those consuming seaweed-containing complementary foods; (c) adolescents, given their elevated iodine requirements during growth; and (d) individuals with pre-existing thyroid conditions or those taking thyroid medication, for whom iodine intake requires careful management. Such guidance should be developed collaboratively between nutrition, endocrinology, and food safety experts, and should account for regional iodine status baselines. A one-size-fits-all approach is insufficient.

Recommendation 6: Issue Positive Dietary Guidance Incorporating Seaweed

National dietary guidelines should include positive, evidence-based guidance on seaweed consumption as a source of iodine and other nutrients, rather than leading with caution alone. The pragmatic recommendation emerging from expert consensus is to consume seaweed once or twice per week in modest portions for the general adult population. Age-specific guidance should be developed, with precautionary restrictions for children under three and cautious recommendations for children aged three to six. Guidance for pregnant and lactating women should be developed based on emerging evidence, acknowledging both the importance of adequate iodine in these groups and the need for controlled intake.

Recommendation 7: Invest in Targeted Research

Current limitations in standardized iodine analysis, bioavailability assessment, and digestion methodologies hinder comparability across studies and complicate risk-benefit assessments and regulatory decision-making. Funding should prioritize the following research areas: (a) human intervention studies on iodine absorption, metabolism, and excretion from seaweed in realistic dietary contexts; (b) standardized in vitro bioaccessibility studies using the Infogest protocol, measuring iodine at the correct physiological stage; (c) iodine content and speciation in seaweed species commonly consumed in Southeast Asia, Africa, and the Southern Hemisphere; (d) mechanisms of population-level tolerance to high iodine intake in Japanese and other seaweed-consuming populations; (e) cost-effective, rapid iodine testing tools for production-level use; (f) optimized processing methods that reduce iodine while preserving other beneficial compounds; and (g) broader health endpoints beyond thyroid function, including effects on cancer epidemiology, the gut microbiome, and radiological protection. Funding for this work could be obtained, *inter alia*, by redirecting government subsidies that support harmful outcomes towards more climate- and nutrition-friendly ones, such as seaweeds and seaweed iodine research.

Recommendation 8: Advance International Regulatory Harmonization Through Codex Alimentarius

The ongoing inclusion of seaweed within Codex Alimentarius frameworks represents a major opportunity for internationally harmonized guidance. The current patchwork of regulations creates trade barriers, market distortions, and consumer confusion. International bodies, including the Codex Alimentarius Commission and the FAO/WHO, should work toward a harmonized framework for iodine in seaweed that is science-based, proportionate, and distinguishes between species groups. They should also support the development of internationally harmonized analytical methods, reference materials, and shared databases for iodine in seaweed and seaweed-based foods.

Emerging economies, especially in Southeast Asia and sub-Saharan Africa, should be engaged in standard-setting to ensure that resulting frameworks reflect global dietary realities. Industry associations, consumer groups, civil society, smallholders, and food systems stakeholder organizations should be part of this global process. The UN Global Seaweed Initiative and its member states, as well as the WHO/FAO Joint Expert Committee on Food Additives (JECFA), should champion it. Regulatory convergence should aim not for a single global threshold, but for shared principles: risk-benefit assessment, regulation based on the product as consumed, species differentiation, mandatory labeling, and recognition of processing as a legitimate compliance pathway.

5. Implementation Pathway

To reach expert consensus, these recommendations have been shared with experts who participated in the process and with additional experts, including some who volunteered. The

recommendations have now been validated, with slight adjustments, following the second workshop.

Annex 1 presents an initial stakeholder mapping for each policy recommendation. This mapping is intended to inform specific interventions tailored to stakeholder types.

The following overarching pathway is proposed for advancing these recommendations from expert consensus toward policy action:

June 2026: Engage the UN Global Seaweed Initiative and member states in the policy reform agenda. Present a consensus statement and this policy brief at the Seaweed for Health Conference (Dar es Salaam, Tanzania). Share findings with participants at the Our Ocean Conference.

2026–2027: Publish a comprehensive white paper consolidating the scientific evidence from the process. Launch targeted research programs in partnership with institutions from North America, Europe, and Asia. Develop a stakeholder engagement plan with food systems stakeholders, civil society, smallholders, and consumer groups. Engage Codex Alimentarius and regional regulatory bodies on harmonization.

2027–2028: Support pilot countries in developing updated dietary guidelines that include seaweed. Work with industry on voluntary labeling standards as a precursor to mandatory requirements. Complete and disseminate the DALY-based risk-benefit analysis.

6. Conclusion

Iodine deficiency is a solvable problem, yet it persists at a massive scale, with consequences most acutely felt by pregnant women, infants, and young children in the world's most resource-constrained settings. Seaweed represents an extraordinary natural resource that the planet has concentrated with this essential nutrient. The science shows that, with appropriate processing, species selection, consumer education, and regulatory frameworks, seaweed can safely and sustainably complement salt iodization as a public health strategy. The barrier is not biological, it is institutional.

Fragmented regulations, an insufficient evidence base, absent labeling, a skewed risk-benefit framing, and a Global South data deficit have collectively prevented seaweed from taking its place alongside iodized salt in the global nutrition toolkit. The expert consultation workshop reinforced the urgent need to address these gaps equitably. This policy brief calls for a paradigm shift: from treating iodine in seaweed primarily as a hazard to be minimized, toward recognizing it as a nutrient to be harnessed—for all populations, in all regions, at all stages of life.

The eight recommendations set out here provide a concrete, actionable roadmap. The time to act is now—the evidence base is growing, the expert community is aligned, the global need has never been greater, and the window for shaping international standards is open.

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Contacts:

GSC: Azzedine Badis (azzedinebadis@globalseaweedcoalition.org), Mélanie Cueff (melanie.cueff@sb-roscoff.fr), Nichola Dyer (nicholajdyer@outlook.com)

ISA: Helena Abreu (Helena@algalink.eu), Susan Løvstad Holdt (suho@food.dtu.dk)

Annex 1: Stakeholder Mapping by Policy Recommendation

Recommendation	Government Organs & Role	Civil Society	Consumer Groups	Industry Associations	International Organizations
1 Adopt a Risk-Benefit Framework <i>Move from safety-only to balanced DALY-based analysis, weighing excess iodine risk against the well-documented global burden of iodine deficiency.</i>	National food safety agencies (EFSA, FDA, ANSES, etc.): Commission and conduct DALY-based risk-benefit analyses; update regulatory thresholds accordingly Ministries of Health: Integrate balanced risk-benefit framework into national nutrition policy and dietary guidance	Public health research institutes & epidemiologists: Develop DALY methodology; contribute data and analytical models for risk-benefit assessments Global health and nutrition NGOs: Advocate for iodine deficiency risk to receive equal policy weight to excess intake risk	Health advocacy coalitions: Ensure deficiency burden is weighted proportionally along with excess risk in safety assessments Patient communities (iodine deficiency): Provide input on lived impacts of deficiency to inform DALY calculations	Seaweed industry associations (GSC, ISA, regional): Supply product composition data and consumption data for risk-benefit assessments Food industry federations: Engage constructively in public consultations on revised risk-benefit frameworks	WHO / FAO: Develop and disseminate global DALY-based risk-benefit methodology for iodine in seaweed JECFA: Conduct integrated safety and benefit evaluations at international level World Bank / UNDP: Build analytical capacity in food safety agencies of low- and middle-income countries
2 Regulate Products as Consumed <i>Apply iodine thresholds to the product as sold and typically prepared by consumers, not to raw/dried biomass; formally recognize processing as a compliance pathway.</i>	European Commission (DG SANTÉ): Adopt 'product-as-sold' as EU regulatory principle; implement EFSA-proposed thresholds on finished products, not raw biomass National food safety agencies: Revise threshold methodologies and define sampling protocols at point of sale National standards bodies: Establish measurement protocols for iodine in processed and prepared seaweed products	Food systems research organizations: Document and publish evidence on processing-related iodine reduction rates across methods Environmental NGOs: Advocate against penalizing ecologically valuable seaweed species based on raw-material concentration	Consumer protection organizations: Ensure regulatory thresholds reflect realistic consumer exposure scenarios Health consumer groups: Support exposure-based rather than concentration-only regulatory approaches	Seaweed processors & producers: Document, standardize, and share processing methods and iodine-reduction data Food manufacturing associations: Demonstrate compliance through validated post-processing testing Analytical testing providers: Develop validated, rapid iodine testing methods for post-processing use	Codex Alimentarius Commission: Formally adopt 'product-as-consumed' as an international regulatory principle FAO / WHO: Publish technical guidance on the effects of processing on iodine content in seaweed ISO: Support harmonization of standards globally for iodine obtained from seaweeds
3 Establish Species-Level Differentiation <i>Distinguish brown, red, and green seaweeds in all regulations and public communications;</i>	National food safety agencies: Establish species-specific iodine thresholds distinguishing high-iodine brown seaweeds from red/green species	Taxonomic & marine biology research institutions: Produce peer-reviewed species classification datasets and species-level	Consumer organizations: Advocate for clear species identification on product labels as prerequisite for	Seaweed industry associations (GSC, ISA, regional): Provide comprehensive species-specific iodine	Codex Alimentarius Commission: Develop internationally harmonized, species-differentiated iodine standards

Recommendation	Government Organs & Role	Civil Society	Consumer Groups	Industry Associations	International Organizations
<i>apply proportionate, species-specific thresholds rather than a one-size-fits-all approach.</i>	Customs & trade authorities: Apply differentiated import controls and testing protocols by seaweed species group Health ministries: Update public dietary communications and safety guidance with clear species distinctions	iodine concentration profiles Scientific community: Advocate for species-specific evidence standards in regulatory submissions	informed choice Specialty food consumer communities: Support proportionate, science-based species differentiation in guidelines	datasets; lobby for proportionate, differentiated standards Specialty food producers & associations: Represent producers of lower-iodine species (nori, dulse, sea lettuce) against blanket restrictions Retailers & food service operators: Require species-level documentation from suppliers and reflect on menus/labels	FAO Fisheries & Aquaculture Division: Maintain up-to-date species taxonomic and production databases ISO: Standardize species identification and iodine measurement methods for seaweed products
4 Mandate Iodine Content Labeling <i>Require all seaweed products to disclose: species present, iodine per serving and per 100g, % of recommended nutrient intake, and — where feasible — post-preparation iodine content.</i>	Food safety & labeling agencies: Draft and enforce mandatory iodine content disclosure requirements for all seaweed-containing products Consumer protection agencies: Monitor and enforce labeling compliance; impose penalties for non-compliance National standards bodies: Establish reference analytical methods and testing frequency requirements for iodine in seaweed	Food labeling advocacy organizations: Champion consumer right to clear, standardized nutritional information on seaweed Transparency-in-food NGOs: Audit market compliance and publish comparative findings	Consumer rights organizations: Define minimum acceptable labeling requirements through formal consultation processes Thyroid patient associations: Ensure labeling provides sufficient detail for individuals actively managing iodine intake	Seaweed industry associations (GSC, ISA): Develop voluntary labeling standards and pilot schemes as precursors to mandatory requirements Food manufacturers associations: Adapt labeling systems, testing workflows, and absorb incremental compliance costs Analytical testing providers: Develop cost-effective, rapid iodine testing tools suitable for batch-level production use	Codex Alimentarius Commission: Develop internationally harmonized labeling standards and reference analytical methods for seaweed iodine ISO: Standardize analytical methods for iodine determination in seaweed products WHO / FAO: Provide authoritative reference nutrient intake values to underpin labeling % calculations
5 Targeted Guidance for Vulnerable Populations <i>Develop dedicated, evidence-based seaweed consumption guidance for pregnant</i>	Ministries of Health: Commission, develop, and widely disseminate population-specific seaweed	Maternal & child health NGOs: Adapt and disseminate guidance materials to reach vulnerable populations in	Maternal health advocacy groups: Ensure guidance reaches pregnant & lactating	Seaweed & health food industry: Develop appropriately portioned and clearly labeled seaweed products for	WHO: Develop global guidance on seaweed iodine for vulnerable population groups; update relevant technical documents

Recommendation	Government Organs & Role	Civil Society	Consumer Groups	Industry Associations	International Organizations
& lactating women, infants, adolescents, and individuals with pre-existing thyroid conditions.	consumption guidance National nutrition advisory bodies: Issue evidence-based recommendations tailored to each vulnerable group's iodine needs and risk profile Maternal & child health agencies: Integrate seaweed guidance into antenatal, postnatal, and pediatric care programs	community settings Thyroid disease patient advocacy organizations: Translate guidance into accessible communications and distribute to members	women through multiple channels Thyroid patient organizations: Advocate for and communicate tailored, clear advice to at-risk members	vulnerable groups Medical nutrition industry: Consider seaweed iodine profiles in clinical and specialized nutritional formulations	UNICEF: Integrate seaweed consumption guidance into maternal, infant, and young child nutrition programs FIGO (Int'l Federation of Gynecology & Obstetrics): Endorse evidence-based seaweed consumption guidance for pregnant and lactating women
6 Issue Positive Dietary Guidance <i>Update national dietary guidelines to include positive, evidence-based seaweed guidance (e.g., 1–2 servings/week for adults), rather than leading exclusively with caution or avoidance messaging.</i>	National nutrition advisory committees: Update dietary guidelines to include positive, species-specific seaweed consumption recommendations Ministries of Health & Agriculture: Endorse and promote guidance in national public health campaigns and food system strategies Public health agencies: Integrate seaweed into nutrition education materials, school programs, and healthcare provider tools	Nutrition & food systems NGOs: Advocate for seaweeds' inclusion in national food-based dietary guidelines Environmental organizations: Amplify sustainability and ecosystem co-benefits of seaweed consumption	Nutrition advocacy groups: Champion positive, balanced messaging about seaweeds as a dietary iodine source Culinary & food culture organizations: Promote accessible recipes and culinary integration of seaweed for general consumers	Seaweed producers & processors: Provide scientific evidence and product data to support guideline development processes Food retail associations: Improve seaweed availability, shelf visibility, and consumer accessibility Culinary associations & food service operators: Integrate seaweeds into professional training curricula, catering menus, and institutional food programs	WHO: Update global dietary guidance frameworks to recognize seaweeds as legitimate iodine and nutrient sources FAO: Include seaweeds in Food-Based Dietary Guidelines technical assistance to member states UN Global Seaweed Initiative: Advocate for positive dietary recognition of seaweed at intergovernmental level and across UN agencies
7 Invest in Targeted Research <i>Fund human intervention studies, standardized bioavailability assessments, Global South species data, and rapid iodine testing tools; redirect harmful subsidies</i>	National research funding agencies: Prioritize grant funding for seaweed iodine research across nutrition, food science, and chemistry disciplines	Universities & research institutions (incl. Global South): Conduct human intervention studies, in vitro bioavailability assessments, and species-level iodine profiling in	Patient advocacy organizations: Facilitate participant recruitment for studies involving vulnerable populations Nutrition advocacy	Seaweed industry associations (GSC, ISA): Co-fund priority research; provide standardized, well-characterized biomass samples	WHO / FAO: Coordinate global research agenda; define and communicate priority evidence gaps to funding bodies World Bank / CGIAR: Finance seaweed nutrition research in

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<i>toward seaweed and seaweed iodine research.</i>	Ministries of Science & Education: Fund human intervention studies and standardized bioavailability assessments using Infogest protocol Agriculture & aquaculture agencies: Support research on optimized processing methods that preserve co-nutrient benefits while achieving safe iodine levels Public Finance authorities (Finance, Planning Ministries): On the basis of country-level assessments of public finance implications of inaction, make funding available, including by redirecting subsidies that support harmful outcomes	underrepresented regions (SE Asia, Africa, Southern Hemisphere) Public health research organizations: Study iodine from seaweed specifically in vulnerable populations with appropriate ethical safeguards Scaling Up Nutrition and public finance accountability NGOs: advocate for more efficient and effective use of public finance to support positive nutrition outcomes	groups: Lobby for sustained public research investment in seaweed nutrition	Analytical testing industry: Develop rapid, cost-effective production-level iodine testing tools Aquaculture industry: Invest in research on processing methods that reduce iodine while preserving omega-3s, minerals, and vitamins	Global South institutions and build local research capacity; analyze cost to public finances of inaction Philanthropic funders (e.g., Gates Foundation): Support large-scale nutrition research in LMICs targeting the iodine deficiency burden
8 Advance Int'l Regulatory Harmonization <i>Pursue a harmonized Codex Alimentarius framework built on shared principles: risk-benefit assessment, regulation of products as consumed, species differentiation, and mandatory labeling; ensure meaningful Global South participation.</i>	National trade & food safety ministries: Engage actively in Codex working groups and contribute national scientific and regulatory data Food safety agencies: Participate in Codex Committee on Contaminants; drive evidence-based standard-setting Foreign affairs & trade offices: Champion regulatory harmonization in multilateral fora and WTO Sanitary and Phytosanitary	Civil society organizations at Codex: Represent public health and consumer interest in international standard-setting processes Smallholder & coastal community associations: Ensure Global South voices and traditional practices are represented in Codex standards	Consumers International (CI): Participate as consumer representative body in all relevant Codex processes Consumer organizations from SE Asia & sub-Saharan Africa: Ensure global and Southern perspectives are meaningfully reflected in harmonized standards	International seaweed associations (GSC, ISA): Serve as active technical contributors in Codex working groups; represent the full seaweed value chain Global food industry federations: Advocate for science-based, trade-enabling international standards Smallholder seaweed farmer organizations: Ensure harmonized standards do not	Codex Alimentarius Commission: Lead harmonization process; develop shared principles framework for iodine in seaweed and seaweed-based foods FAO / WHO JECFA: Conduct safety and benefit evaluations that underpin international seaweed iodine standards UN Global Seaweed Initiative & member states: Champion the Codex harmonization process at

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	Measures (SPS) Committee negotiations			inadvertently exclude small- scale producers in developing countries	intergovernmental level WTO SPS Committee: Monitor and ensure that harmonized standards avoid creating unnecessary barriers to trade
