

Status regarding contaminants and nutrients in seaweed

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Potential risks posed by macroalgae for
 application as feed and food
 - a Norwegian perspective

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National Institute of Nutrition and
 Seafood Research (NIFES)



	Norwegian	English	Latin
Brown per-ennials	Grisetang	Rockweed, egg wrack	<i>Ascophyllum nodosum</i>
	Blæretang	Bladderwrack	<i>Fucus vesiculosus</i>
	Sauetang	Channeled wrack	<i>Pelvetia canaliculata</i>
Brown annuals	Martaum, åletang	Sea lace	<i>Chorda filum</i>
	Remtang	Sea spaghetti	<i>Himanthalia elongata</i>
Kelp	Sukkertare	Sugar kelp	<i>Saccharina latissima</i>
	Fingertare	Oarweed	<i>Laminaria digitata</i>
	Butare	Alaria, winged kelp	<i>Alaria esculenta</i>
	Stortare	Tangle	<i>Laminaria hyperborea</i>
Green algae	Havsalat	Sea lettuce	<i>Ulva lactuca</i>
	Tarmgrønnske	Gut weed, mermaids hair	<i>Enteromorpha intestinalis</i>
	Pollpryd	Sponge seaweed	<i>Codium fragile</i>
Red algae	Søl	Dulse, dillisc	<i>Palmaria palmata</i>
	Fjærehinne	Laver	<i>Porphyra purpurea</i>
	Grisetangdokke	Wrack siphon weed	<i>Polysiphonia (Vertebrata) lanosa</i>
	Krusflik	Irish moss	<i>Chondrus crispus</i>



-> Iodine, iAs, Cd main focus

COMMISSION RECOMMENDATION (EU) 2018/464**of 19 March 2018****on the monitoring of metals and iodine in seaweed, halophytes and products based on seaweed****(Text with EEA relevance)**

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 292 thereof,

Whereas:

- (1) For arsenic, cadmium and lead, maximum levels (MLs) for various foodstuffs are established under Commission Regulation (EC) No 1881/2006 ⁽¹⁾. However, under this Regulation for foodstuffs derived from seaweed, MLs are not established for halophytes, except for the MLs established for seaweed.
- (2) For mercury, currently under Council ⁽²⁾ a maximum residue level (MRL) for algae and prokaryotic products derived from seaweed.
- (3) In 2006 the Scientific Committee on Food concluded that excessive iodine intakes, if endemic iodine deficiency is present, may be harmful to the health of children of 1-3 years ⁽³⁾. It concluded that excessive iodine intakes, if endemic iodine deficiency is present, may be harmful to the health of children of 1-3 years.
- (4) Available occurrence data show that seaweeds contain significant concentrations of arsenic, cadmium, iodine, lead and mercury. As halophytes also grow in a marine environment, it can reasonably be assumed that they will show a similar uptake pattern of these substances and by consequence a similar contamination pattern.

EFSA wants data

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32018H0464>



Update 2020

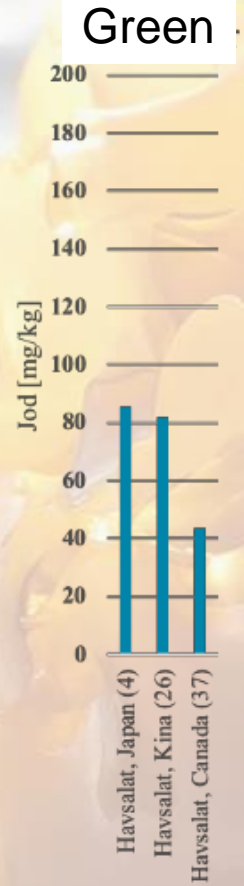
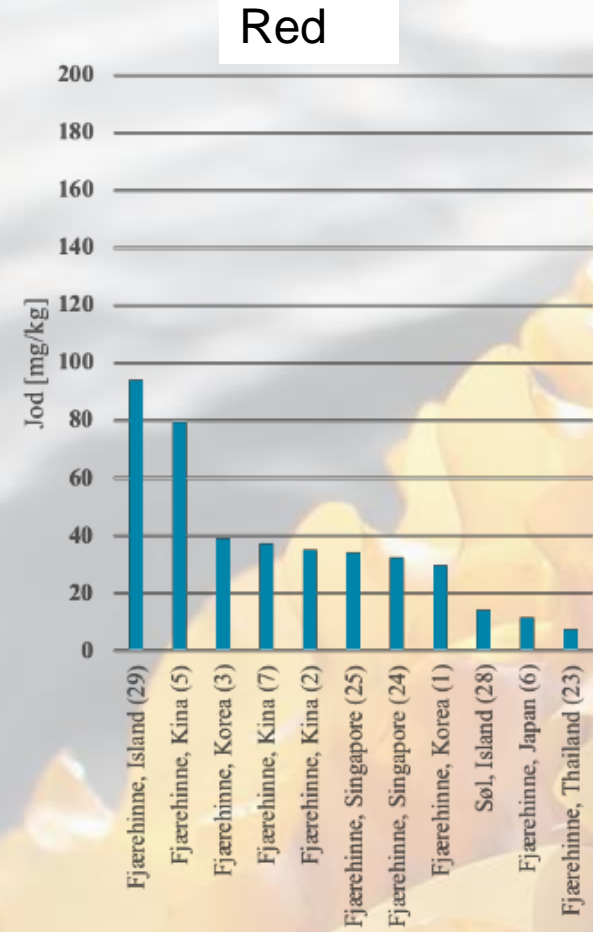
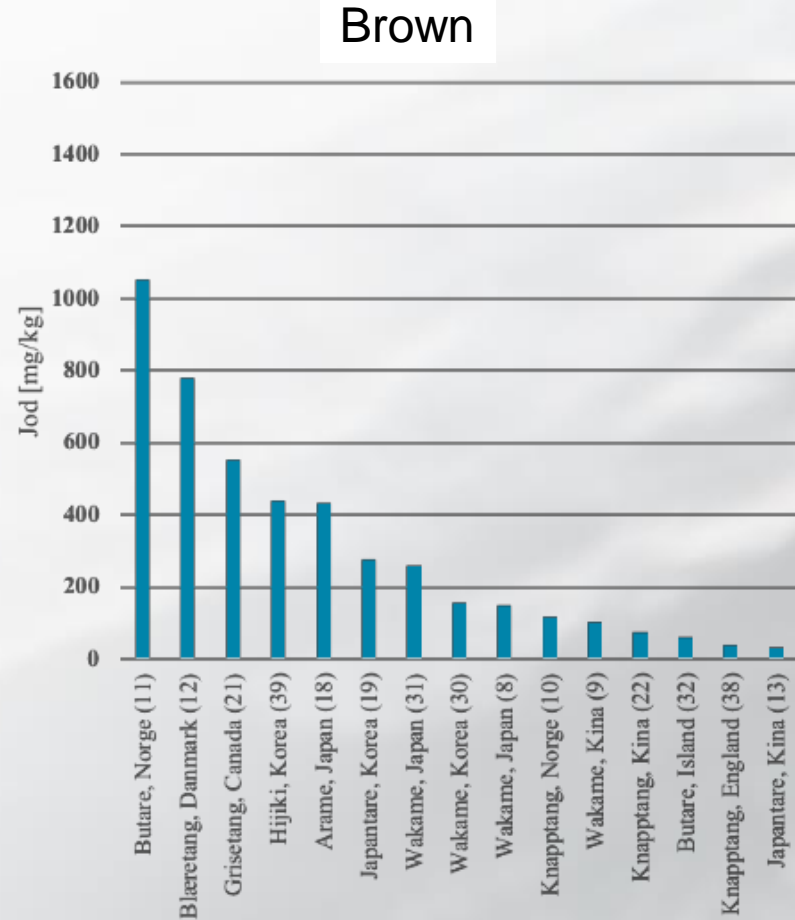
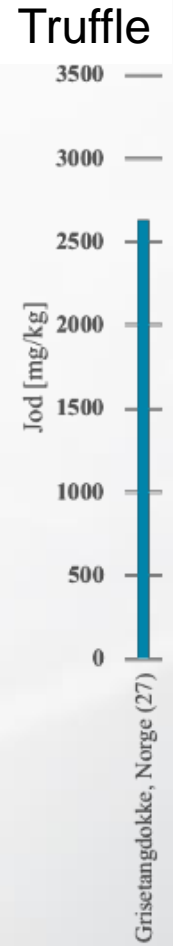
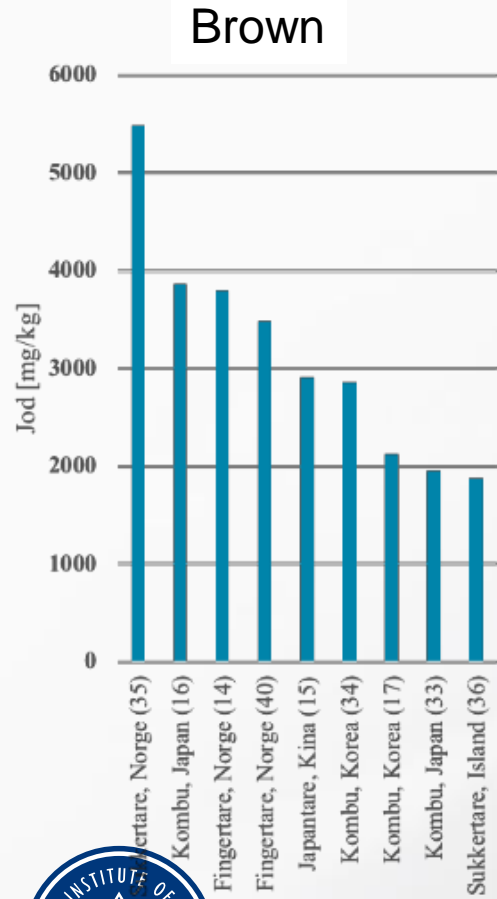
- 30 species but 14 with >4 samples
- More detailed information
 - discriminate between «normal» and «high» species

Number of analyses:

Latin name	Iodine	iAs	Cd
<i>Saccharina latissima</i>	157	79	150
<i>Alaria esculenta</i>	30	33	40
<i>Laminaria digitata</i>	32	39	32
<i>Fucus vesiculosus</i>	27	23	27
<i>Palmaria palmata</i>	26	23	26
<i>Ascophyllum nodosum</i>	24	22	24
<i>Fucus serratus</i>	20	18	19
<i>Vertebrata lanosa</i>	18	19	18
<i>Ulva lactuca</i>	12	10	12
<i>Porphyra spp</i>	11	11	11
<i>Ulva intestinalis</i>	7	6	7
<i>Porphyra umbilicalis</i>	6	5	6
<i>Himanthalia elongata</i>	5	4	5
<i>Undaria pinnatifida</i>	5	5	5
<i>Saccharina spp</i>	4	4	4
<i>Porphyra purpurea</i>	3	3	3
<i>Pelvetia canaliculata</i>	3	2	3
<i>Fucus spiralis</i>	3	2	3
<i>Laminaria hyperborea</i>	2	5	2
<i>Halidrys siliquosa</i>	2	2	2
<i>Chondrus crispus</i>	2	2	2
<i>Chorda filum</i>	2	2	2
<i>Codium fragile</i>	2	2	2
<i>Sargassum muticum</i>	2	2	2
<i>Ulva spp</i>	1	1	1
<i>Eisenia bicyclis</i>	1	1	1
<i>Laminaria</i>	1	1	1
<i>Sargassum fusiforme</i>	1	1	1
Sum	409	327	411

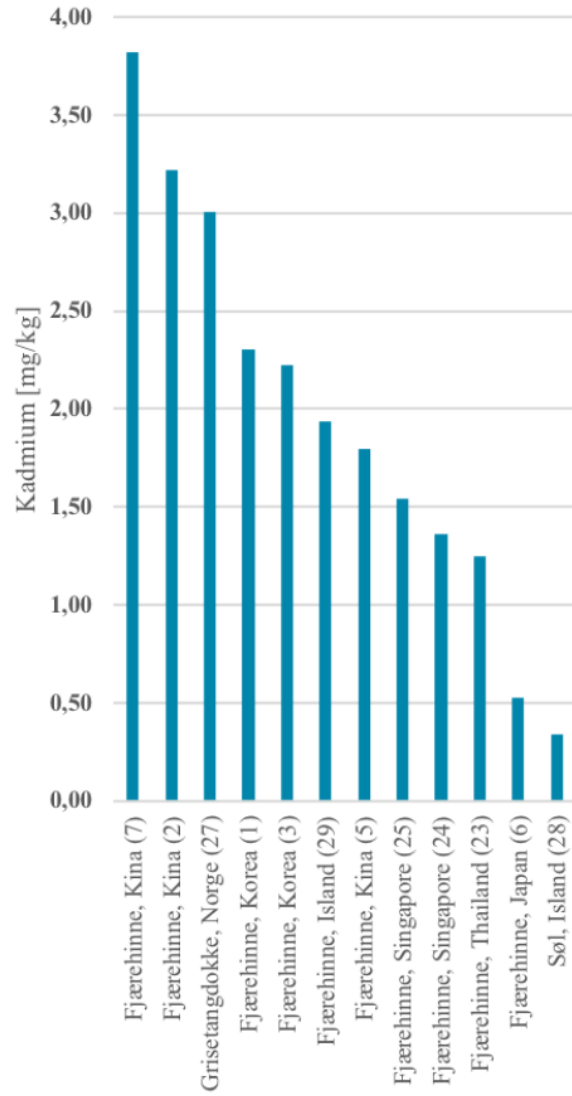


Iodine in products – including Asia

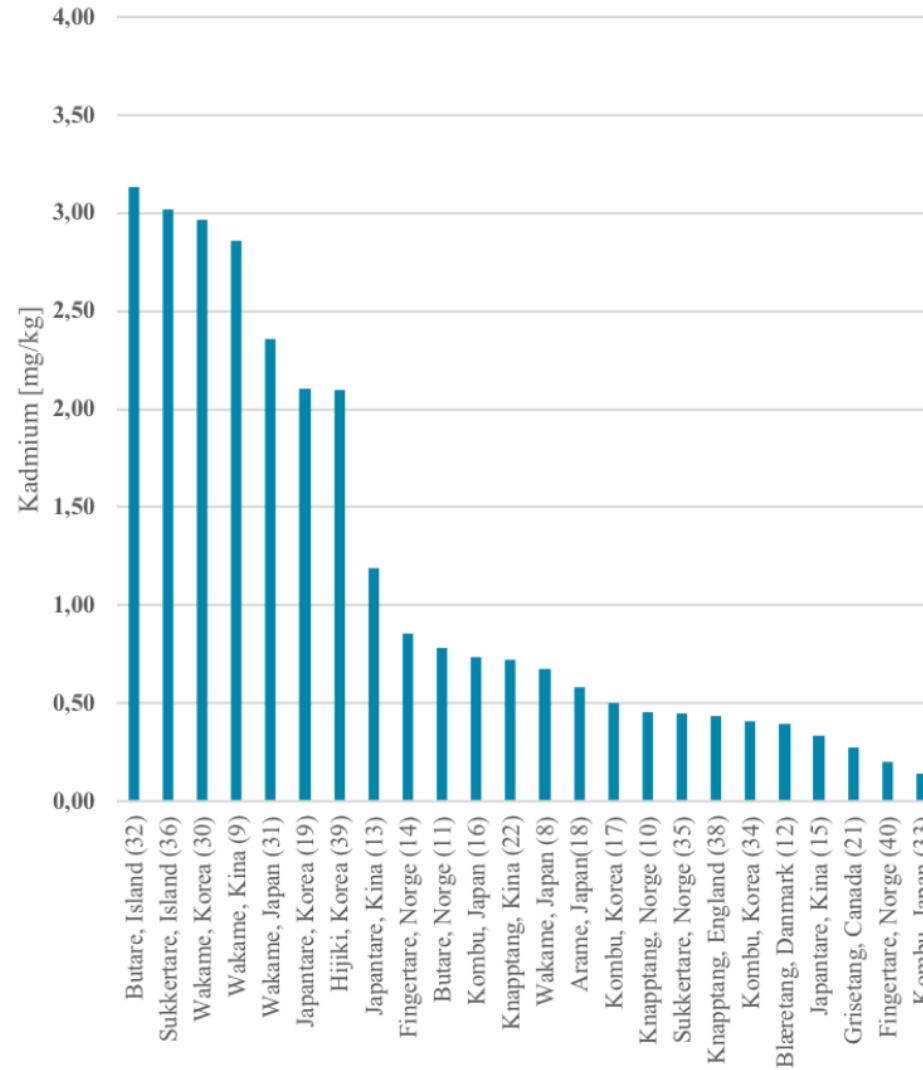


Cadmium

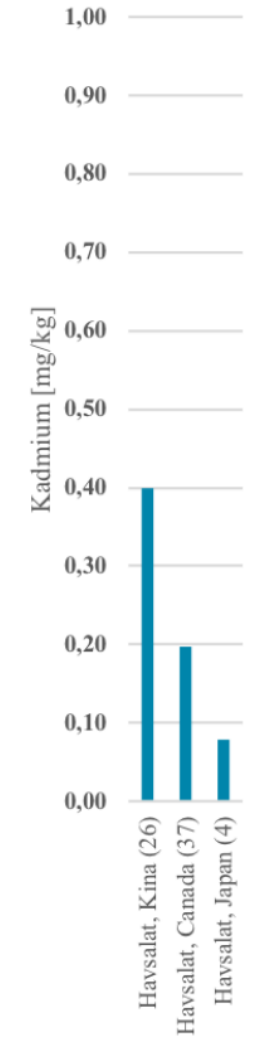
Rødalger



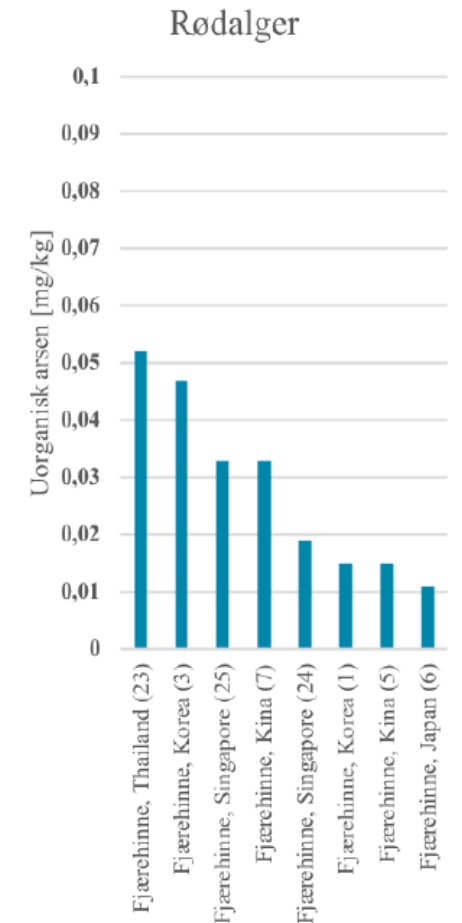
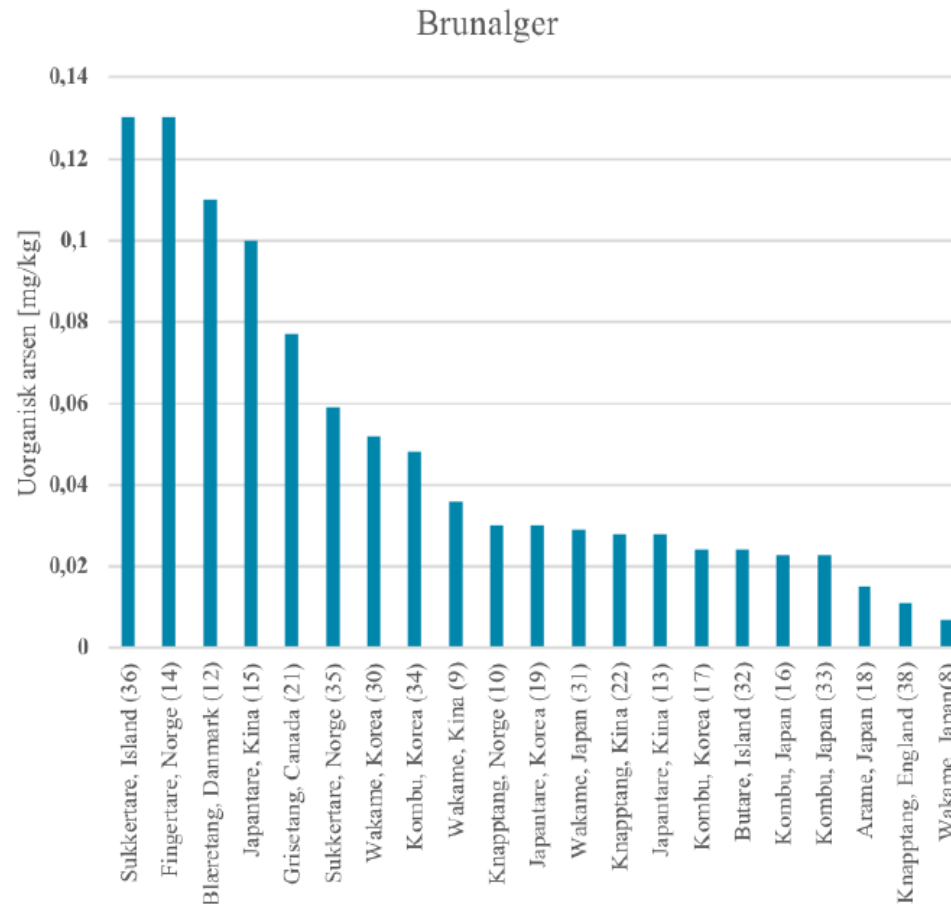
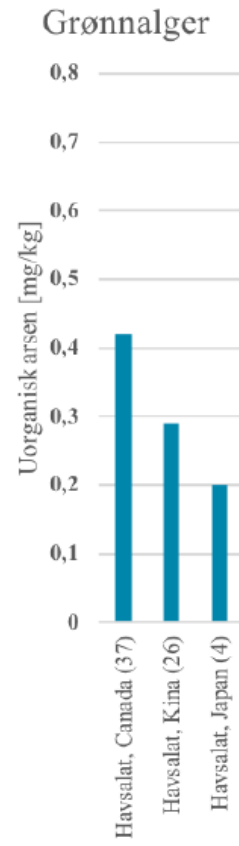
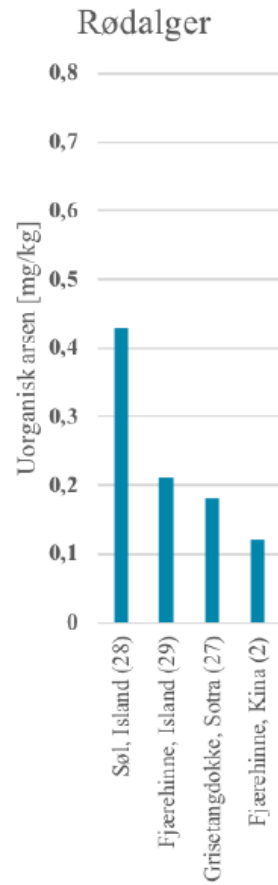
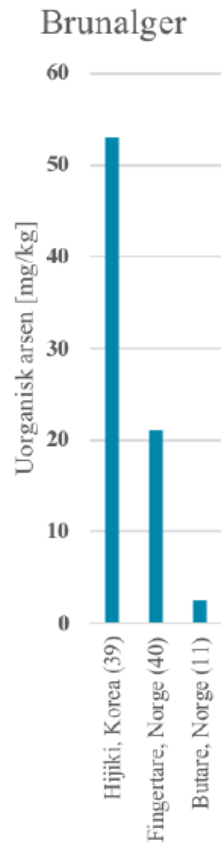
Brunalger



Grønnalger



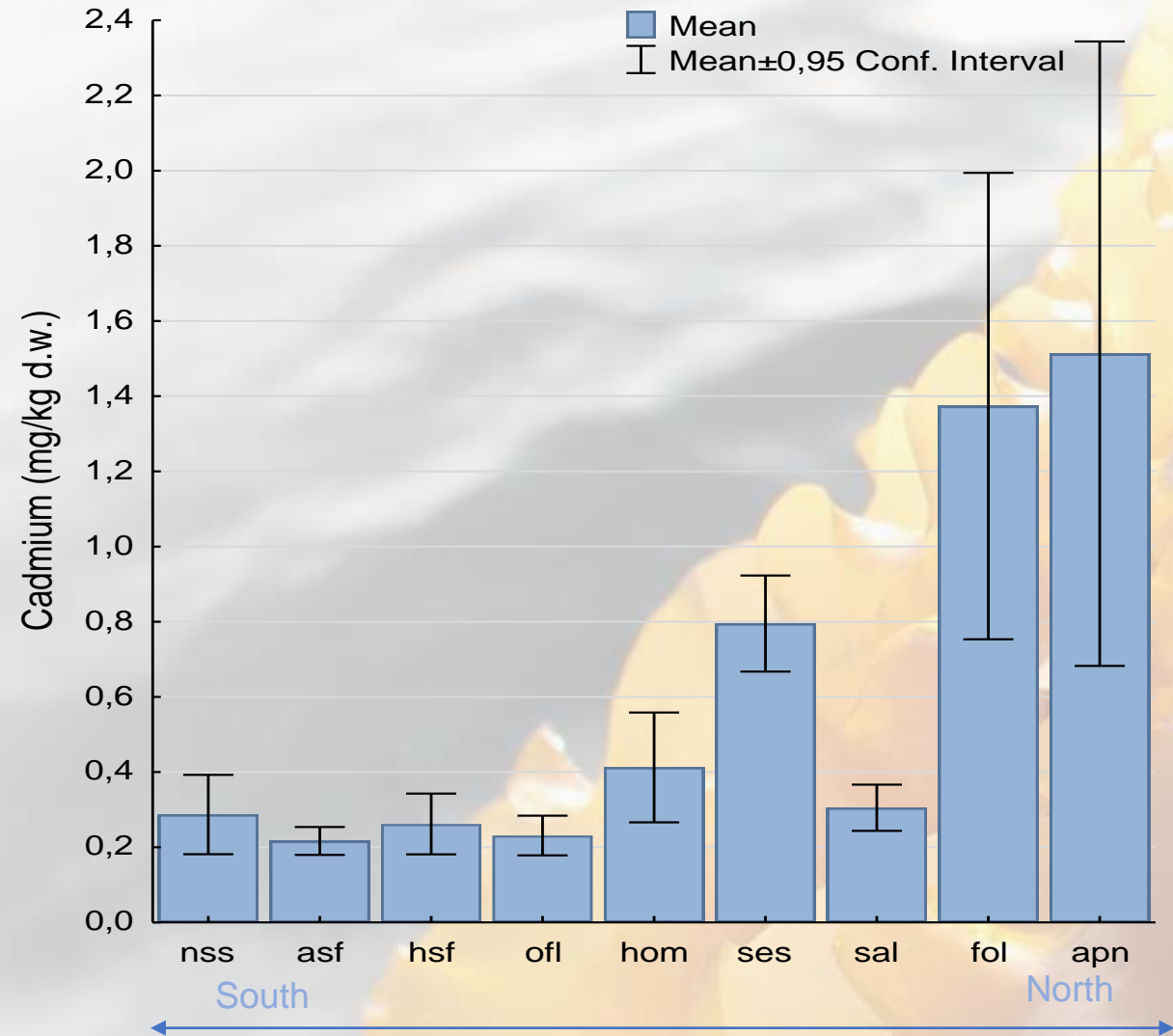
Inorganic arsenic



Saccharina: Geographical variation Cd

MACROSEA (SINTEF): Standardised cultivation on 9 sites from south to north in Norway

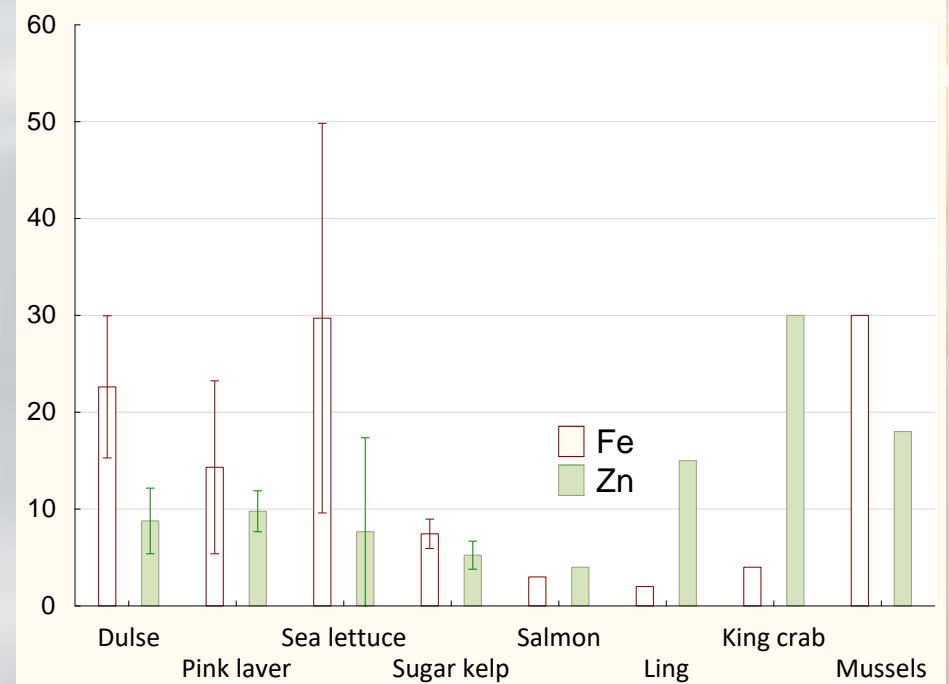
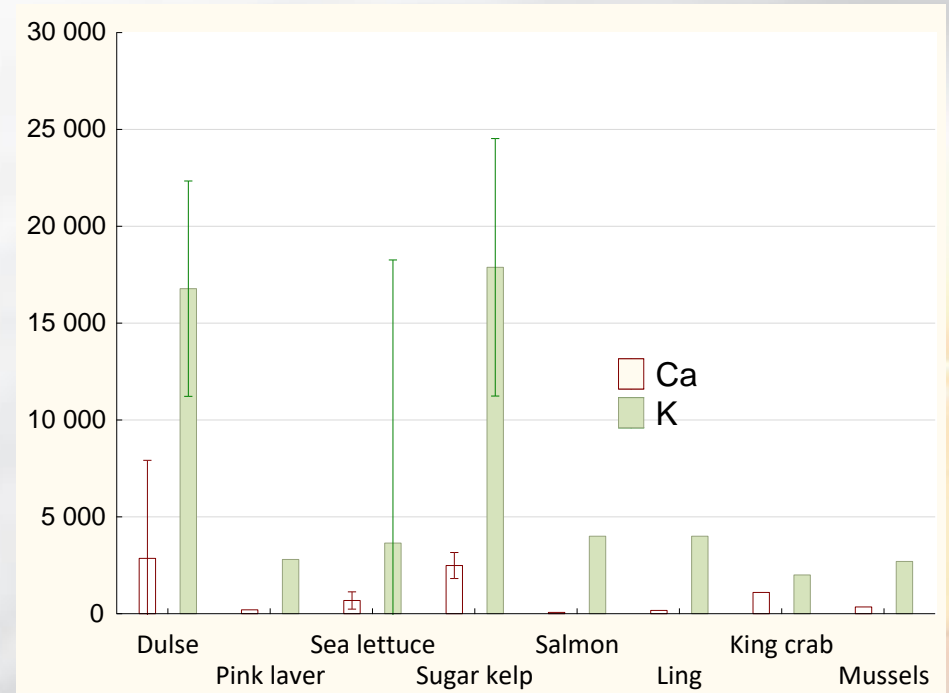
Limit for feed ingredients 1.0



Nutrients (mg/kg ww)

- Good source of minerals
- Few data on vitamins this far.

Latin name	Number of analyses	
	Zn, Fe, Se	Ca, K, P..
Saccharina latissima	150	52
Alaria esculenta	40	12
Palmaria palmata	26	6
Ascophyllum nodosum	24	6
Fucus vesiculosus	27	4
Laminaria digitata	32	4
Porphyra purpurea	3	3
Ulva intestinalis	7	2
Fucus spiralis	3	2
Porphyra umbilicalis	6	2
Ulva lactuca	12	2
Sargassum muticum	2	2
Fucus serratus	19	1
Pelvetia canaliculata	3	1
Laminaria hyperborea	2	1
Halidrys siliquosa	2	1
Himanthalia elongata	5	1
Chondrus crispus	2	1
Vertebrata lanosa	18	1
Codium fragile	2	1
Sum	385	105



Effect of cooking on iodine

- Iodate is volatile and water soluble
- Boiling in water releases 50-90 % of iodine and 50% to air
- Continued boiling of the stock reduces further 50 %
- Frying releases 50 % (25-80)
- Drying releases about 25 %



Effect of high intake of kelp in rodent model

- Dried sugarkelp: 5% of diet for 12 weeks
- Rats tolerant to high iodine. No harmful effects of sugar kelp.
- About 70% uptake. Release via kidneys to urine
- Ongoing analysis of urine and blood samples from seaweed eaters



Arame	Arame	<i>Eisenia bicyclis</i>
Bladderwrack	Blæretang	<i>Fucus vesiculosus</i>
channelled wrack	Sauetang	<i>Pelvetia canaliculata</i>
Dead man's rope	Martaum	<i>Chorda filum</i>
<i>Halidrys siliquosa</i>	Skolmetang	<i>Halidrys siliquosa</i>
Hijiki, dried	Hijiki, Tørket	<i>Sargassum fusiforme</i>
Kombu	Kombu	<i>Saccharina</i> spp
Laminaria	Laminaria	Laminaria
Oar weed	Fingertare	<i>Laminaria digitata</i>
Rockweed	Grisetang	<i>Ascophyllum nodosum</i>
Spiral wrack	Kaurtang	<i>Fucus spiralis</i>
Sugar kelp	Sukkertare	<i>Saccharina latissima</i>
Tangle	Stortare	<i>Laminaria hyperborea</i>
Thongweed	Remtang	<i>Himanthalia elongata</i>
toothed wrack	Sagtang	<i>Fucus serratus</i>
Toothed wrack, dried	Sagtang	<i>Fucus serratus</i>
Wakame	Wakame	<i>Undaria pinnatifida</i>
Winged kelp	Butare	<i>Alaria esculenta</i>
Wireweed	Japansk drivtang	<i>Sargassum muticum</i>

