https://www.hi.no/hi/nettrapporter/rapport-fra-havforskningen-en-2020-44#

Seaweed in our seafood database

Knowledge update on macroalgae food and feed safety

— based on data generated in the period 2014-2019 by the Institute of Marine Research, Norway

Authors: Arne Duinker, Malin Kleppe, Even Fjære, Irene Biancarosa, Hilde Elise Heldal, Lisbeth Dahl and Bjørn Tore Lunestad (IMR)

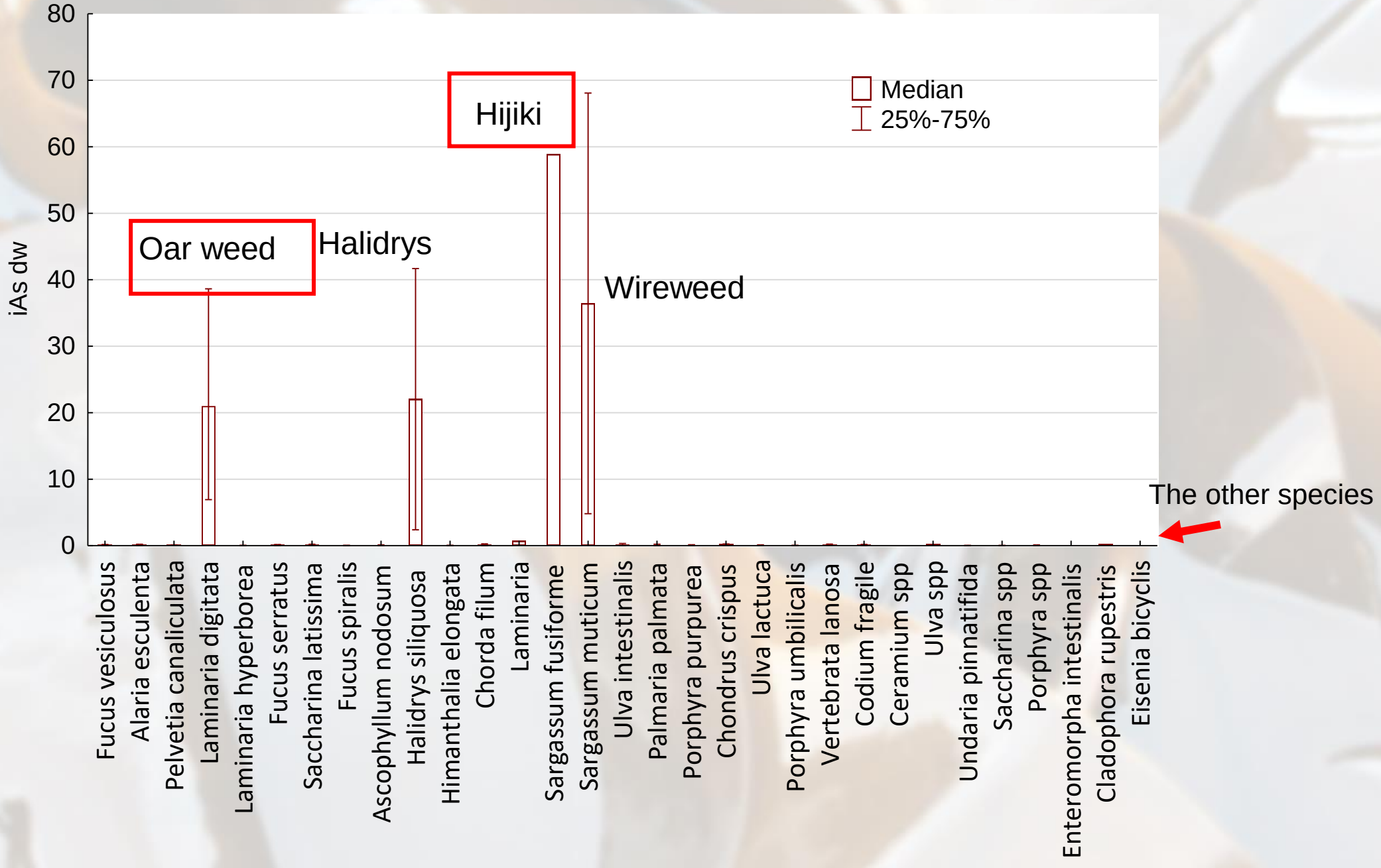
Report series: *Rapport fra havforskningen* 2020-44 ISSN: 1893-4536 *Overvåking sjømat*
Published: *08.12.2020*
On request by: *Norwegian Food Safety Authority* Reference: *2015/253280*
Research group(s): *Fremmed- og smittestoff (FRES)* Subject: *Nye marine ressurser til mat og fôr*
Program: *Trygg og sunn sjømat*
Reasearch group leader(s): *Monica Sanden (Fremmed- og smittestoff (FRES))* Approved by:
Forskningsdirektøre(r) en: *Gro-Ingunn Hemre* Program leader(s): *Livar Frøyland*

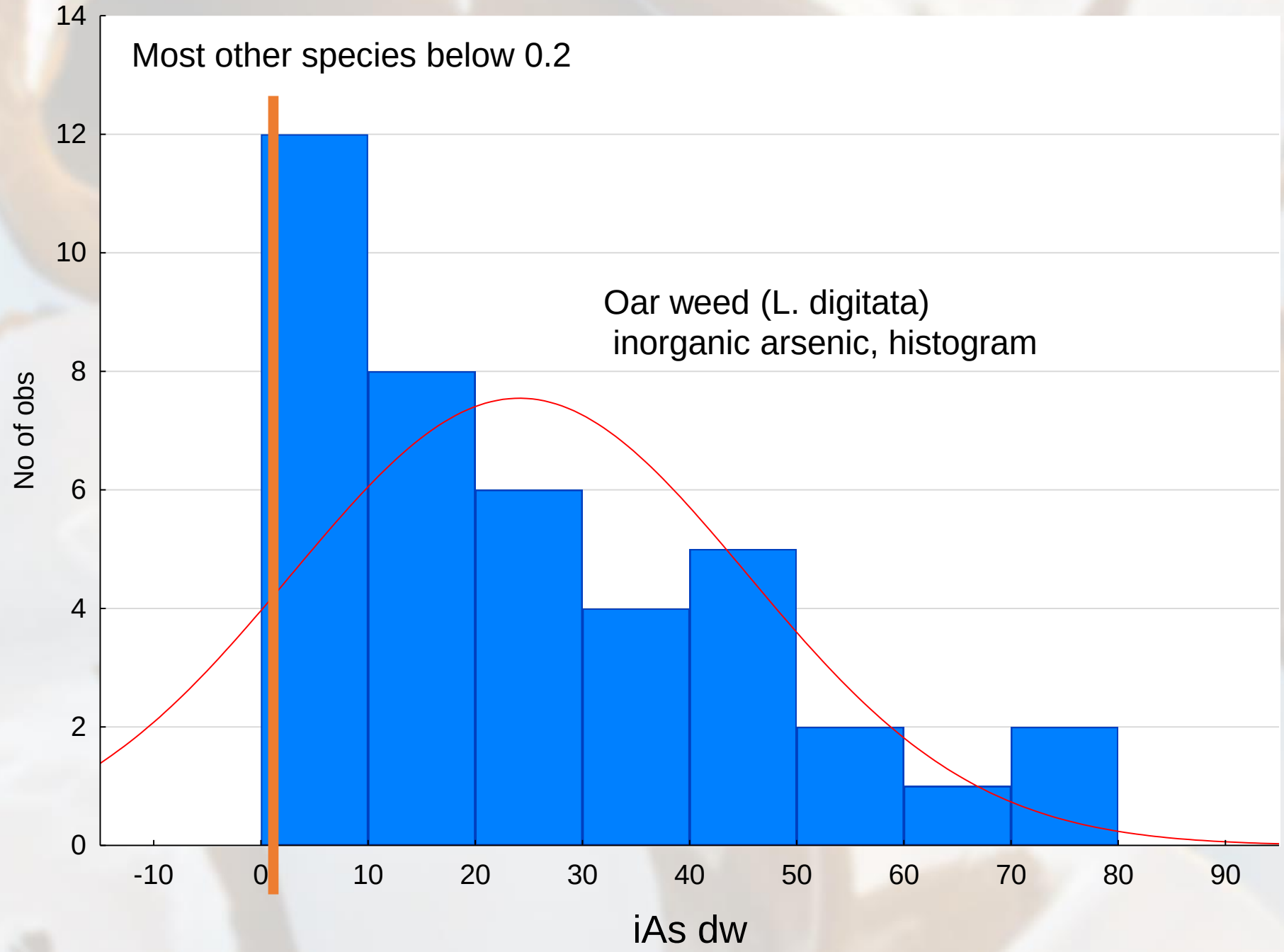
Erling Svensen

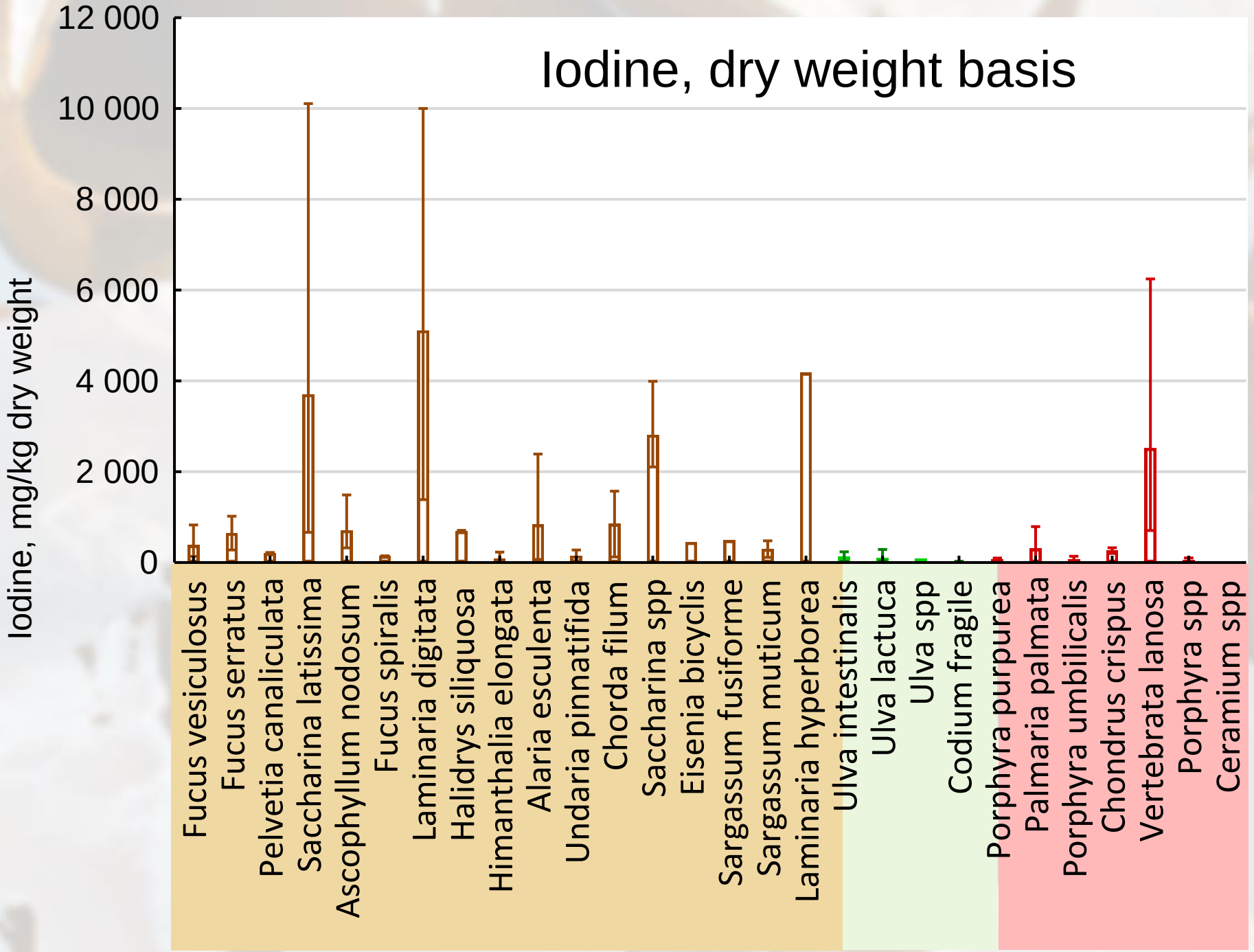
- 27 species and 14 of these with five or more samples.
- ~400 analyses of cadmium, mercury, lead and iodine (+ Fe, Zn, Se)
- 332 analyses of inorganic arsenic.
- 104 analyses of macro minerals, Ca, K, Mg, Na and P
- 150++ localities

- The main updates are:
- **New data on iodine and metals** with increased resolution at the species level (reported to EFSA).
- New data on **inorganic arsenic identifies a group of macroalgae** that hold substantially higher inorganic arsenic concentration than the normal range.
- **Bioavailability of 73-78 % of iodine** from sugar kelp was found in a rat model study
- Imported species with Asian origin had similar levels of iodine and heavy metals to closely related species from Norwegian waters.
- New results demonstrate **iodine reduction** in kelp through drying, boiling and frying.
- New data on kainic acid in dulse shows relatively low levels also in Norwegian dulse.
- Heat-treated products that are stored for some time: Important with cold storage due to the possible presence of **spore forming bacteria**
    - similar to what applies for other heat-treated products as for example dairy products. Spore formers pose a low challenge for fresh or dried seaweed used directly.
- Data on **macro- and microminerals** are presented.
- Experimental use of macroalgae for **fish feed** via insects shows that macroalgae provides marine nutrients into the feed chain, but also that there is a risk that some batches of seaweed are exceeding the maximum levels for cadmium and arsenic in animal feed

Inorganic arsenic, on dry weight




Most other species below 0.2
Oar weed (L. digitata)
inorganic arsenic, histogram
No of obs
0
2
4
6
8
10
12
14
-10
0
10
20
30
40
50
60
70
80
90
iAs dw


Iodine, dry weight basis
Iodine, mg/kg dry weight
12 000
10 000
8 000
6 000
4 000
2 000
0
Fucus vesiculosus
Fucus serratus
Pelvetia canaliculata
Saccharina latissima
Ascophyllum nodosum
Fucus spiralis
Laminaria digitata
Halidrys siliquosa
Himanthalia elongata
Alaria esculenta
Undaria pinnatifida
Chorda filum
Saccharina spp
Eisenia bicyclis
Sargassum fusiforme
Sargassum muticum
Laminaria hyperborea
Ulva intestinalis
Ulva lactuca
Ulva spp
Codium fragile
Porphyra purpurea
Palmaria palmata
Porphyra umbilicalis
Chondrus crispus
Vertebrata lanosa
Porphyra spp
Ceramium spp