

No survival of parasitic nematodes in stockfish

- **Parasitic nematodes** commonly occur in most commercially harvested wild marine fish, such as cod.
- The most important types are *Anisakis*, also known as the **herring-** or **whale worm**, and *Pseudoterranova*, commonly called **cod-** or **seal worm**, as they use whales and seals as final hosts, respectively.
- They are responsible of a fish-borne zoonotic disease called **anisakidosis** since the parasite is capable of provoking human infection following consumption of parasitized raw, marinated or undercooked fish.
- The European Food Safety Authority (EFSA) has concluded that freezing to -20°C for not less than 24 hours or heat treatment at $\geq 60^{\circ}\text{C}$ for at least 1 minute in all parts of the product are the most effective ways to kill the nematodes.



A: Traditional stockfish production



B: *Anisakis* in the flesh of rehydrated stockfish observed by candling



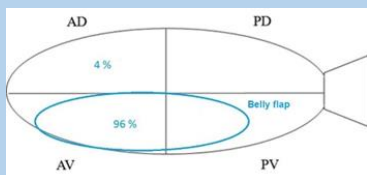
C: Pepsin digestion of rehydrated stockfish was used to assess the viability of nematodes.

RESULTS

In fresh cod (*skrei*), most of the nematodes are located in the viscera but some may also occur in the flesh, especially in the **belly flaps**.

The traditional outdoor drying process of stockfish kills the nematodes.

The fillets of 50 fresh cod (*skrei*) were examined for the presence of *Anisakis*. Every cod sampled had at least 1 *Anisakis* in their fillets (100% of occurrence). Almost all *Anisakis* were located in the belly flaps (see figure below).



A total of 80 rehydrated stockfish fillets were examined for the presence of *Anisakis*. At least 1 *Anisakis* was present in 81% of the fillets (81% of occurrence). The lower percentage of *Anisakis* occurrence in stockfish compared to fresh cod was due to the fact that the belly flaps had been removed in some stockfish fillets (see figure below).



Anisakis recovered after peptic digestion of rehydrated stockfish. All *Anisakis* found were **dead**.

CONCLUSIONS

Results suggest that all nematodes possibly present in rehydrated stockfish are dead. Thus, the risk of acquiring anisakidosis from consumption of rehydrated stockfish is considered zero.

Trimming the belly flaps of highly parasitized fish can strongly reduce the number of *Anisakis* in stockfish. Candling may be used to remove some nematodes that may be visible in the fillets.