**EAAM Fish Quality and Handling**

Fish species

It is generally recommended that a varied diet will aid the proper nutritional care of marine mammals.

To give a diet as varied as possible is not only important from the nutritional point of view, but also to make sure that the animals under our care are used to eating different fish species, thus allowing for proper feeding even if one or two species are not available in the mid term e.g., if for any reason herring or sprat were not available for 6 months, the animals of our collection could still feed on other fish species if they are used to them. Should they only routinely feed on two species, this could cause health problemsthrough inappetance when faced with unusual food items..

The fish species usually used in marine mammal parks are the following:

* Herring (all year around)
* Capelin(all year around)
* Squid (summer months)
* Sprat (3-6 months a year, winter months mostly)
* Mackerel (only excellent quality, only in the winter months)
* Blue whiting (Usually given during the summer months, without head and spine to avoid abrasions in oesophagus)
* Smelt
* Mussels (Walrus)
* Clams (Walrus)
* Hake (Belugas)

Vitamins

Marine mammals that are exclusively fed on frozen fish need to be supplemented with vitamins. There are several brands available e.g. IZVG Aquavits and Aquaminivits, Mazuri Fish Eater Tablets, etc, but care will need to be taken to administer the proper amount considering product, species and weight.

Freezing temperature and defrosting of the fish

According to the USDA manual: Handling Fish Fed to Fish-Eating Animals (https://www.aphis.usda.gov/animal\_welfare/downloads/marine\_mammals/mmfish.pdf)the freezer temperature should be maintained between-30 and -18Cº, although it seems, again according to the above mentioned manual, that there is less nutrient loss and oxidation of the fish if the temperature is maintained below -23Cº.

The optimal defrosting temperature, following afore mentioned USDA manual, is between 4 and 6Cº, although it is known that above 4Cº the risk of *Erysipelas* growth increases. It is thus recommended not to exceed this 4Cº.

Fridge and freezer maximum and minimum temperatures should be measured and recorded on a daily basis, and compared to a standardized thermometer at least twice a year.

The defrosting of the fish must be done appropriately to decrease nutrient loss, to avoid peroxidation of the fat, bacterial growth and loss of palatability.

Fish should be defrosted in the fridge, not at ambient temperature or under running water. Microwave is also not acceptable as a defrosting method.

Fish will thus be defrosted in the fridge for a maximum of 24 hours. Big size fish blocks can be cut in half with disinfected saws to facilitate defrosting, but more fish will then be wasted.

It is recommended to measure fish temperature before feeding it to the animals at least one month per season (summer, autumn, winter and spring) to guarantee that the temperature it is being kept at is the appropriate one.

Defrosted fish will be given only for 24 hours after defrosting.

Humidity of the freezer

The humidity of the freezer should not go below 85-90%, which helps decreasing the dehydration of the frozen fish.

Freezer ventilation

It is recommended to have appropriate ventilation that maintains a uniform temperature throughout the whole freezer.

Fish handling

Fish should be manipulated hygienically and maintained a temperature below 4Cº.

Fish should be sorted and the ones with broken/damaged parts shouldbe discarded.

All the utensils used in the handling and preparation need to be carefully washed and disinfected afterwards. The kitchen needs to be thoroughly cleaned on a daily basis and disinfected at least once a week.

It is not advisable to feed frozen fish to marine mammals. It can be given cold, but not frozen.

Fish should be covered in ice in the warmer areas of our planet, but buckets then need to have a grid at the bottom to allow the fluid to drain to the bottom and not be in contact with the fish.

Offered fish should be palatable, can’t be contaminated, be in sufficient amount and with appropriate nutritional value to guarantee the animals health.

Fish needs to be maintained for a short a time as possible out of the fridge prior to being fed.

Recommended maximum freezing period

Maximum freezing time of the different species, post capture, always with the analysis within acceptable rage values.

* Herring: The ideal would be to buy herring twice a year, once from each hemisphere, to guarantee an optimal nutritional value.
* Capelin: Only caught once a year, it is acceptable to store it for one year post capture.
* Squid: Usually given during the summer months, to provide low Kcal intake and extra water content.
* Sprat: Very high fat content. Not recommended to store it for more than 6 months post capture.
* Mackerel: Not recommended to store it for more than 3 months post capture. Due to the possibility of scombroidosis.Histamine test is a must.
* Hake: One year post capture.
* Blue whiting: Given usually in the summer and thus only stored for about 6 months.

Quality parameters

These parameters need to be measured every time a new batch arrives. Records needed include: batch number, arrival date, analysis date, capture date, date this batch is opened and offered to the animals, supplier and type of fish.

Microbiology:

* Mesophilic aerobes – max 1.000.000 ufc/gr
* Enterobacteria – max 1.000 ufc/gr
* Salmonella – absence/25gr

Physicochemical Analysis:

* Fat
* Humidity
* Proteins
* Ashes
* Carbohydrates
* Kcal
* Histamine – max 100 ppm
* Peroxides – max 10 meq/Kg fat
* TBA = Thiobarbituric acid analysis - method to assess lipid oxidation in fish - 1,5-3,5mg/Kg
* ABVT/TVBA (total volatile basic amines)< 25 mg/100 (Reg. 2074/05)

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| FROZEN FISH SUPPLIERS TABLE | | | | |
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