

C.S.

Miscellaneous  
(Reports)

1924.

No. 50/24.

S of S Dep No 102.

SUBJECT.

1923.

15th November.

Previous Paper.

The use of whale flesh as food.  
Report by Miss M Dyer  
Department of Scientific & Industrial  
Research.

MINUTES.

S of S Dep No 102 of 15 Nov<sup>r</sup> 1923 (1)  
Report by Miss M Dyer. (1a)

Assistant Government Naturalist.  
For information  
M.D. 18  
Oil Sec 25 Jan 1924.

Comments by Asst Govt Naturalist 23/1/24 (2)

Y.P. Submitted  
M.D. 18  
Oil Sec 25 Feb 1924

Subsequent Paper.

Mr. Hamilton shall report his  
views

W.H.H. 4 March 24

Mr. J. S. Hamilton

Referred

9th. 13

or/for

5 March 1904

Hon. Col. Sec.

Thank you.

2. A number of casks of whale meat were salted this year at DeLator Company's land station where many rather small whales were brought in in fresh condition.

With reference to the salting I was informed that the most scrupulous care united to experience is necessary in order that the whale meat may be entirely free from the slightest trace of "burning" which is the whalers' name for the putrefactive process. Carelessness in this respect was a cause of the failure of commercial <sup>whale</sup> meat salting in Farsø.

3. It is perhaps possible that when the process has begun its action spreads rapidly so that a small piece of tainted meat will affect other pieces with which it comes in contact.

4. It might be possible to conduct canning or chilling or salting meat on the Falklands which are only four or five days steaming from S. Georgia and S. Westland but I fear there might be difficulty in collecting sufficient cargo for a vessel in the time limited by the oxidation process.

The time of transit from Blue Station to Rowdon would probably be about 48 hours.

5. The light thrown by the research on the changes of oil on the so-called "burning" of the whale carcasses is interesting.

This process has always appeared to me to be too rapid to be accounted for by bacterial action.

It is accompanied by much heat, the development of much gas (which includes ammonia) and by loss of oil, being most rapid in fat whales.

I would submit that it may be largely due to the oil oxidation, in addition to the ordinary putrefactive processes, which would of course be accelerated by the heat ~~too~~ which is doubtless generated by the oxidation of the oil. J. S. Hamilton

Y.S. Submitted  
G.P. 17  
O.P.S.  
17 March 1924

A copy of Mr. Hamilton's note  
excluding the 2<sup>nd</sup> para of para 34  
might be sent with an acknowledgment  
sent of the despatch

H.H.H. 17 March 24

Despatch No 36 of 20 March 1924  
to S.P.S.,  
Enclosure to Despatch

(3)  
(3)



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FALKLAND ISLANDS.

DOWNING STREET,

No. 102

**DUPLICATE** 15 November, 1923.

Sir,

I have the honour to transmit to you the accompanying copy of a report by Miss E. Eyer on the Report. Use of Whale Flesh as Food, together with a report in original by the Imperial Institute on Whale Bones from the Falkland Islands.

I have the honour to be,

Sir,

Your most obedient,

humble servant,

(Signed) DEVONSHIRE

THE OFFICER ADMINISTERING

THE GOVERNMENT OF

THE FALKLAND ISLANDS.

Confidential



1a

# THE USE OF WHALE FLESH AS FOOD

by

Margaret Dyer.

At a large whaling station the oil of the whale is recovered, but the flesh is either converted into manure or goes to waste. It is true that, for example, in the Faroe Islands, the inhabitants exercise the permission which they have received to salt down some of the flesh for their own consumption, but the amount so saved for human food, when the whale fisheries of the world are considered as a whole, is negligible. The enquiry, of the results of which this is a report, was started at the instance of the Colonial Office to determine whether more use could not be made of the flesh to supplement human food supplies.

Whale flesh is already used as human food, either in the canned form or as sausages. I believe, however, it is generally admitted that these products might be improved upon.

## Analysis of Whale Flesh.

The whale flesh was sent from the Shetland Islands in a specially constructed insulated box consisting of an inner box in which flesh could be stored out of contact with ice. The space about this inner box was filled with crushed ice in which was embedded other portions of flesh.

On opening the inner box the large amount of fluid which had exuded from the flesh was noticeable. This liquor was bright red, but darkened on standing.

Both meat and fluid were analysed. The figures, quoted below, show that in composition whale flesh compares favourably with butcher's meat. The content of water was high. Protein was estimated as nitrogen by the Kjeldahl method.

TABLE 1.

Sample from		Water	Protein	Fat	Ash.
1st consignment.		75.5	20	0.1 - .03	-
Samples from	A	74.8	25.6	1.7	1.0
2nd consignment	B	67.3	29.2	3.9	1.1
<u>For purposes of comparison.</u>					
Beef (lean)		69.2	21.9	7.3	1.2
Rump steak					Phimmer Analyses and
Veal -Hindquarter		74.1	20.4	2.7	1.3
					Energy Values of Foods.

### Character of the Meat.

The meat was bright red in colour not at all unlike beef. The fibres of the meat were loosely held together and the fibrous structure showed very clearly. Long white threads ran through it, and these were clear when cooked. The meat cut very easily and is altogether softer than ordinary meat. There is no suggestion of fat as occurs in beef, and some was, therefore, added in the preparation of dishes.

### COOKING TRIALS.

#### Baking.

The meat was baked in the oven with the addition of lard for basting. The joint was put into a hot gas oven (temperature 300°F.) for five minutes and then the gas was lowered and the joint cooked at a mean temperature of 350°F. The time allowed for baking is always difficult to judge, and the time chosen was such as would be given to a piece of beef. The joint did not brown well, neither was there much savoury smell as is usual from baked meat. There were more droppings or juices as distinct from dripping or fat than one would have expected from a similar sized piece of beef. See Table II.

Table II

Date	Time of Cooking	Mean temperature of oven.	Weight of meat before cooking	Weight of meat after cooking	% loss in weight	Weight of drip minus fat.	% of loss recovered as dripping
May 22nd	1 hour	350°F	lbs. ozs. 1. 13	lbs. ozs. 1. 4½	29.3	ozs. 4½	50
" 25th	2 hours	350°F	6. 15.	5. 1½	26.3	13½	45.3

1. This is weight of joint + stuffing.


The joint was served cold. The meat was carved thinly, care being taken to cut across the fibres. The meat was brown in colour (lighter in colour than well done beef, and darker than veal) with a reddish tinge in the centre. There were rows of dots of clear gelatinous substance between the bands of meat. These were not so noticeable when the joint was hot.

The meat was extraordinarily tender, but somewhat tasteless, otherwise a good substitute for beef.

#### Stewing.

The meat was cooked in a good brown sauce made from water, flour, and clarified fat; and flavoured with onions, salt and pepper. It was tasted by various people, who

/agreed



agreed that it was tender, but had little flavour. The remains of the stew were made into rissoles, which were carefully seasoned and met with entire approval.

A hot pot was made of the whale flesh, potatoes, onions, flour, water, salt and pepper. The criticisms were much more favourable; it was considered savoury and superior to the roast in flavour. No oily or fishy taste was noticeable in any of these dishes.

From these preliminary experiments it was found that there was no difficulty as regards tenderness of the meat but that extra care was needed in seasoning and that savoury sauces were advisable.

#### Baked Stuffed Meat.

Two joints of whale flesh were backed with veal stuffing in a pocket through the centre and served with a piquante sauce. These joints were considered satisfactory, and there was no mention of a fishy flavour.

#### Dishes from Minced Meat.

As the ultimate object was to can the flesh, and as it is easier to flavour minced materials, various dishes were prepared. The work was undertaken by some of the degree students at the College, and the students reported on the palatability.

#### Galantine.

This was one of the most satisfactory ways of dealing with the flesh. The addition of bacon gave just the flavour that the plainer dishes lacked. All the reports were favourable.

#### Collops.

These were made from fresh minced meat. The whale flesh was found to require more salt than normal. Thyme and pepper were added, and the dish was then found to taste just like ordinary meat.


#### Sausages.

More flavouring than usual was required. The result was then quite palatable.

An attempt was made to use the red fluid collected from the inner box of the insulated box used for conveying the meat from Lerwick to make a kind of black pudding, but with no satisfactory result.

It may be concluded from these trials that the flesh of the whale, when fresh, is not only suitable for human food, but really good of its kind. It is not deteriorated by a fishy flavour, and it may be likened to tender veal, with, however, rather less flavour than good veal usually has.

/Even



Even in the matter of flavour, samples differ, as might be expected. In the first sample, the want of flavour was commented upon; the second sample, which was utilised mainly for canning had much more flavour than the first, and its taste was not unlike beef. When grilled it was particularly appetising and tender.

The second step was to discover whether whale flesh was suitable for preparing canned foods. Early in this stage of the enquiry we came across what is the real difficulty, namely, the tendency of the meat to develop a rank fishy flavour in proportion as it loses its first freshness.

Salted meat is largely used in canning: some whale meat was therefore salted, some in dry pickle and some in brine. Obviously, if the meat could be salted successfully, it would be better to salt it at the whaling stations and then to ship the product to places where canning might be cheaper than it would be, for example, in South Georgia. The first lot of meat which was salted had been in the ice box for seven days. Ten days later it was soaked in cold water for eighteen hours and cooked. It proved to be quite uneatable owing to a strong and most distasteful oily, fishy, flavour. The cause of this change was investigated.

CAUSE OF THE FISHY FLAVOUR WHICH DEVELOPS AS THE MEAT IS KEPT.

The Journal of Home Economics published in U.S.A., Vol. 14, No. 6th June, 1922, contained an article on the value of whale meat as human food. It is there stated that a "characteristic fishy taste and odour develops within a brief period. The change appears to be due to bacterial action upon the oily part of the meat and can be lessened or destroyed only by parboiling for one minute in weak bicarbonate solution (.5%).". It seemed unlikely that bacteria should be active in the presence of such a concentrated salt solution, and it was suggested that the noxious taste might be due to the oxidation of the fat. Another sample of whale flesh was therefore devoted to an investigation of the following:-

1. Whether the change of flavour was due to bacterial action or to oxidation.
2. The length of time that the whale flesh could be kept before the flavour was noticeable.
3. Whether the meat salted as soon as it arrived would be suitable for the preparation of canned goods or freshly made dishes.

In the second sample of whale flesh the meat was darker in colour and firmer in texture. The colour was deeper than the

/colour



colour of raw beef, but the meat was not so firm as beef usually is. This meat was cut from two male fins killed on September 1st and flenched the following forenoon. Each was about 65 ft. long. The meat was taken from the place which is usual when it is required for the purpose of eating, namely, from the fillet on the back of each side of the spine.

With this sample there also arrived a barrel of meat which had been salted according to the directions given in the Appendix. As it is known that the composition of whale flesh varies considerably, specimens of the second sample of fresh meat were analysed. The results are given in table I.


The fat was estimated by extracting a dried weighed sample with petrolum ether in a Soxhlet apparatus. The oil, when extracted, was found to have slight traces of the characteristic fishy odour.

#### Bacteriological Examination.

Small pieces of meat when cultured in the ordinary laboratory media, produced a rich growth of numerous organisms, both in the presence and in the absence of oxygen. The meat therefore as it arrived was, as might have been expected, by no means sterile, but the activities of the bacteria which were present, up to this point at any rate, had not resulted in the development of the fishy flavour. Some pieces were sterilised by being autoclaved at 115°C. for 30 minutes. They were then found to be quite sterile, but it was noticed that the process of autoclaving had itself caused the development of a pronounced fishy smell, which increased when the sterile meat was incubated at 37°C. The rapid development of the fishy odour on heating the meat, and its increase under sterile conditions, suggested that it was due to chemical changes and not to bacterial action. The fishy odour is certainly quite distinct from the smell produced by ordinary proteolytic and putrefactive bacteria.

#### Chemical Tests.

It is known that many otherwise tasteless and odourless oils acquire a strong flavour on oxidation. Linseed oil is a well-known example. A known weight of the oil which had been separated from the whale flesh was therefore kept in a desiccator for seven days. On re-weighing a gain in weight of, on the average, 4.5 parts per hundred, was found. This gain could have been due only to the absorption of oxygen. So far as one could judge, the distinctive fishy odour had increased during the period, but it must be remembered that such judgments are difficult and uncertain.



The Length of Time the Whale Flesh can be kept chilled before the Fishy Flavour develops.

The test which was applied consisted in grilling and tasting small pieces of the meat. The first suspicion of the unwanted flavour was noticed by the writer fifteen days after killing, but it was not commented on by others who tasted the flesh at a meal. Twenty days after killing, however, the meat was distasteful to all consumers.

It may be concluded that if whale flesh is kept at or about 0°, not more than fifteen days can be allowed to elapse between killing and canning.

CANNING TRIALS.

Fresh Meat.

As whale flesh most resembles beef in flavour and in appearance, it was decided to use it as beef is used in the preparation of canned articles. Stewed whale flesh was prepared and canned, mustard and cayenne pepper being added in addition to other flavourings (such dishes are generally called "devilled"). Ordinary methods of canning were followed and the cans were processed in the usual way. The product was considered thoroughly palatable. Roast whale flesh was also prepared and canned, but found unattractive, both in flavour and appearance.

Salted Meat.

The salted meat was prepared as corned whale and also to form the basis of a minced mixture similar to "Camp Pie", which is made from salted beef. Corned whale, when eaten cold, had the fishy, oily flavour slightly developed, and it seemed to increase on keeping the meat out of the tin for two or three days. The smell of fishy oil was very noticeable when the tin was opened.

In making whale "Camp Pie" the meat was well washed and soaked for from 12 to 14 hours in cold water. It was then minced and mixed with bacon, bread and gelatine and seasoned with pepper, mace, and nutmeg. This mixture was canned, and was also boiled and used as a galantin. The product was of good colour and attractive in appearance. Some of it was sliced and kept for four days without developing any trace of the fishy flavour. On the whole, the "Camp Pie" was the most successful method of treating the whale flesh, but it involved the addition of a large proportion of other constituents.

M. Dyer.

APPENDIX.

Salting Whale Meat.

As soon as the blubber is taken off, cut away the meat in large pieces and remove them from the flenching platform to a clean place. Cut the large pieces into smaller ones, size 10 x 10 inches, or larger, but in no case smaller. Thickness not exceeding two inches and not thinner than  $1\frac{1}{2}$  inches.

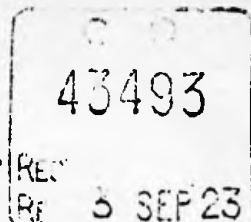
Take barrel, clean it with hot water and strew fine, clean salt on the bottom, so that the whole bottom be covered with about  $\frac{1}{2}$  inch. (take care that the barrel be well dried before packing). Pack the meat carefully and take good care that everything be as clean as possible. No two pieces of meat must be in touch with each other, every packed layer being covered by  $\frac{1}{2}$  inch salt. The pieces should not be folded. Mix the salt before starting with a little saltpeter, well pulverized. Use strong barrels, tighten the seams with caulk to prevent leakage, as it is of great importance that the brine (pickle) should not run away.

Extract from a letter from Mr. J. Foden, Olna Whaling Co., Shetland:-

"The whale, from which we cut the meat to be salted, was a small male Fin-whale, 57 feet long. It was killed in the morning of the 1st September and the beef was cut at 4 p.m. the same day and salted the following morning ....."

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## THE USE OF WHALE FLESH AS FOOD.

NOTE.

Early in 1922, at the request of the Colonial Office, the Food Investigation Board undertook the organisation of an enquiry into the use of whale flesh as human food. The Board were fortunate enough to secure the help of Miss M. Dyer, who undertook the whole of the laboratory and cooking tests. Through the courtesy of Messrs. Chr. Salveson & Co. of Leith samples of flesh were obtained from their whaling station at Lerwick, Shetland Islands. Thither the whale, when killed, is at once towed; so that it was possible to place the flesh in a specially constructed insulated box, together with sufficient ice to last until it arrived at the Household and Social Science Department of King's College for Women, where, by the courtesy of the Dean, the tests were carried out.


The insulated box was carefully precooled, and the flesh always arrived in good condition, owing to the care taken by the Manager of the Whaling Station, Mr. H.H. Henriksen and by Messrs. Hay & Co. of Lerwick, who saw to the transit of the box. Throughout the enquiry no difficulty due to the distance of the source of supply from the laboratory was experienced, and for this the Board is indebted to those gentlemen already mentioned and to the steamboat and railway officials.

The result is illuminating, but, in some respects, disappointing. Whale flesh, when quite fresh, is excellent food. A portion roasted in the ordinary way is hardly to be distinguished from veal, except by its greater tenderness. It can also be canned with success or used to make salantine or camp pie. It suffers, however, from a grave defect. The amount of fat or oil present in the flesh is considerable. Miss Dyer's analyses put this at 4.0 per cent., but other observers have found as much as 17.0 per cent. This would not be a drawback were it not for a peculiarity of the oil. When expressed from fresh flesh it is practically odourless, but it absorbs oxygen readily, even in the cold, and the oxidised product has a rank fishy flavour. This property is without doubt owing to the presence of unsaturated molecules. The change in character is not due to bacteria, as has been asserted, nor to enzymes.

The development of the fishy flavour can be delayed by cold, that is, by chilling to 0°C. for from a fortnight to three weeks. Salting was tried, but it did not arrest nor even greatly delay the oxidation of the oil in the flesh. Actual freezing was not tried, because the unusual tendency which whale flesh has to drip would almost certainly be increased to a disastrous degree by freezing and thawing.

Broadly, one may conclude that even with chilling whale flesh ceases to be a palatable form of food in from ten to fourteen days after death. Miss Dyer was unable to confirm the claim the claim that the fish flavour, when developed, can be got rid of by boiling with weak alkali (0.5% soda). On the other

/hand



hand, the fishy flavour, when not too pronounced, can be masked by flavourings and addition of bacon and bread. In this way a galantine could be made which was thoroughly palatable.

Even with this time limit whaling stations such as those in the Shetlands are probably sufficiently near the centres of supply to permit of successful canning. It is another matter, however, in the Antarctic stations, where fuel for factory work would be too costly and the flesh must therefore be transported a long distance before it could be canned.

There is also another consideration to be reckoned with when the possibility of saving the flesh of Antarctic whales for food is under debate. Mr. Henriksen had had many years experience of whaling at the South Georgian station before he moved to the Shetlands, and he informs us that the Antarctic whales yield much more oil than do the northern whales. If this means that the flesh contains more fat, the tendency to develop a fishy flavour may be greater, and the time available after death for successful canning thereby shortened. On the other hand, the climate of South Georgia would afford natural chilling of the flesh.

W.B. HARDY.

August, 1923.

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On 6/650

The supply of whale "beef" in the Antarctic is enormous. Much of the meat would be useless as food, because whale meat for human consumption must be taken from the whale within a few hours of death or it will develop a rank taste.

I doubt if it would be found commercially profitable to run a separate "ship" meat cannery.

On the other hand I understand that the flukes of a whales tail together with the fin, & flippers are the parts of a whale most esteemed as articles of diet in Japan. Moreover these portions are of very little, or no value for oil purposes. The freezing of these for the Japanese market might be considered.

The efforts to find the cause of the bad taste in kept whale meat, discloses in the chemical tests a most interesting point for oil makers to further note. = That oil exposed to air, oxidises rapidly even to 4.5% in 7 days i.e. a gain in weight. This would indicate that as little access to air as possible is desirable in the production & storage of whale oil.

M. F. 50/24.

FALKLAND ISLANDS.

No. 36.

GOVERNMENT

STATIONER

20th Dec

Sir,

I have the honour to acknowledge receipt of the Duke of Devonshire's No. 102 of the 15th of November, 1922, containing a report by Miss M. Dyer on the use of whale flesh as food, and to attach a note of the Government Naturalist commenting on the report.

I have the honour to

Sir,

Your most obedient,  
humble servant,

H. Henniker-Heaton.

THE RIGHT HONOURABLE

J. H. THOMAS, P.C., M.P.,

SECRETARY OF STATE FOR THE COLONIES.

20th March, 1924.

Note by Mr. J. E. Hamilton, M.Sc. F.Z.S.,  
Government Naturalist.

A number of casks of whale meat were salted this year at Hektor Company's land Station where many rather small whales were brought in in fresh condition.

With reference to the salting I was informed that the most scrupulous care united to experience is necessary in order that the whale meat may be entirely free from the slightest trace of 'burning' which is the whalers' name for the putrefactive process: carelessness in this respect was a cause of the failure of commercial whale meat salting in Faeroe.

It is perhaps possible that when the process has begun its action spreads rapidly so that a small piece of tainted meat will affect other pieces with which it comes in contact.

It might be possible to conduct canning of chilled or salted meat in the Falkland Islands which are only four or five days steaming from South Georgia and South Shetlands but I fear there would be difficulty in collecting a sufficient cargo for a vessel in the time limited by the oxidation process.

The light thrown by the research on the change of oil on the so-called 'burning' of the whale carcass is interesting.

This process has always appeared to me to be too rapid to be accounted for by bacterial action.

It is accompanied by much heat, the development of much gas (which includes ammonia) and by loss of oil being most rapid in fat whales.

I would suggest that it may be largely due to the oil oxidation in addition to the ordinary putrefactive processes, which would of course be accelerated by



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oxidation of the oil.

(sgd) J. E. Hamilton,

Government Naturalist.

11th March, 1924.

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