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TECHNOLOGICAL STUDIES ON THE PROCESSING OF SEA LIONS

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ABSTRACT

Sea lions are predators on the commercial fisheries of Alaska. Under certain conditions the processing of sea lions by cold-storage and reduction plants in Alaska might be attractive. The proximate composition of sea lions was determined. The quality of the products that might be produced is discussed.

BACKGROUND

As a result of widespread complaints from commercial fishermen of the depredations caused by Steller's sea lions (Eumetopias jubata) and on a basis of a study of the sea lion habits by Imler and Sarber (1947), and other information, the ban from hunting sea lions was removed in 1949. This removal of protection apparently has not reduced appreciably the size of the sea lion herds that cause annoying loss of fish to commercial fishermen, particularly those fishing for halibut and sablefish. A further study of the habits and general biology of these predators is currently being carried out by the Alaska Department of Fisheries under a Saltonstall-Kennedy fund contract awarded by the U. S. Fish and Wildlife Service. To find a commercial use for a predator is one of the best methods for its control. It is with this in mind and also to aid in the harvesting of a possibly valuable resource that additional studies on the technology of handling sea lions are being carried out.

A 650-pound female sea lion.

FACTS ABOUT SEA LIONS

The commercial processing of sea lions would require capturing a large number of the animals. It is very difficult to recover sea lions if they are in the water. It takes a carefully placed shot in the head to kill a sea lion and most of the animals sink quickly when killed. A wounded animal usually escapes capture by diving under water and swimming away or by dying on

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the bottom where he cannot be recovered. A better way then to recover sea lions is to kill them when they are on the land. During June and early July the sea lions haul

A 525-pound mature female sea lion

Skinning a 650-pound sea lion. Cut indicates blubber thickness on brisket.

out on wave-beaten rocks and islands to have their pups and to breed. The rookeries are in exposed locations off the coast of Alaska and extend from Southeastern Alaska to far out among the Aleutian Islands and into the Bering Sea. Here the male holds

Table 1 - Measurements and Yield Data for Sea Lions of Varying Size and Sex

No.	Sex	Length (Nose to Tip of Tail)	Girth (Under Fore-flippers)	Blubber Thickness (on Brisket)	Total Weight	Liver		Hide		Meat (Free of Bone and Blubber)		Blubber	
		(Inches)			(Lbs.)	Weight (Lbs.)	% Total Body Wt.	Weight (Lbs.)	% Total Body Wt.	Weight (Lbs.)	% Total Body Wt.	Weight (Lbs.)	% Total Body Wt.
1	Male	-	-	-	425	13	3.1	28	6.6	274	35.7	63	14.8
2	Female...	-	-	-	343	14	4.1	21	6.1	274	35.7	54	15.8
3	Male	87	72	1¾	695	19	2.7	-	-	-	-	-	-
4	Female...	98	67	-	527	25½	4.8	-	-	-	-	-	-
5	Female...	97	64	1¾	643	20	3.1	36	5.6	202	31.4	79	12.3
6	Female...	89	54	-	484	14½	3.0	24	5.0	153	31.6	52	10.8
7	Male	109	82	2½	1,121	26	2.3	70	6.2	341	30.4	128	11.4

Animals 1 and 2 were sexually immature, probably 2- or 3-year olds.
Animal 3 was in a semidecomposed state when found ashore and complete data were not obtainable.
Animal 4 had well developed fetus and appeared to be nursing; 26 pounds of mammary tissue and milk were recovered. Only partial data were obtained.
Animals 5 and 6 each had a well-developed fetus; no indication of nursing.
Animal 7 had a stomach which weighed 102 pounds; stomachs of other animals weighed less than 20 pounds each. Stomach weights of all animals are included in the total weight.

a harem of 10 to 20 females. The cow bears a single pup and again breeds before she returns to the sea to feed. (Kenyon and Scheffer 1953.) At other times herds of sea lions use favorite rocks to haul out on and rest. The resting spots are exposed places either along the coast or near the mouth of streams.

Table 2 - Proximate Composition of Meals Prepared from Sea Lions

Type of Meal	Moisture	Oil	Protein	Ash
	(Percent)			
Liver meal	12.8	19.7	51.1	5.2
Viscera meal ...	8.0	20.2	70.2	2.9
Bone meal	5.2	27.6	44.7	22.3
Meat meal	5.9	27.0	58.9	3.9

Note: The analyses account for only 88.8 percent of the liver meal and 95.7 percent of the meat meal. Glycogen and other carbohydrates perhaps account for the balance.

Local fishermen and U. S. Fish and Wildlife Service agents and reports (Imler and Sarber 1947) were consulted in plotting on charts the size and location of sea-lion rookeries and hauling-out grounds in southeastern Alaska. A number of rookeries located within a day's run of the herring reduction plants were indicated. Two of the largest rookeries, Forrester Island

and Hazy Islands, are bird refuges on which hunting is prohibited. However, several of the fishermen thought it possible for a crew of four on a salmon seine boat to recover 500 sea lions during the six-week breeding season of June to mid-July. Much larger rookeries, with shorter hauls to reduction plants and cold-storage facilities, are available in the Kodiak-Cook Inlet area.

Table 3 - Proximate Composition of Sea Lions and Herring

Specimen	Moisture	Oil	Protein	Ash
	(Percent)			
Sea lion	58.2	22.1	16.4	3.1
Herring	66	16	16	2

ANALYSES OF SEVEN ANIMALS

Seven animals were recovered near Ketchikan, Alaska, in December 1955 and January 1956 and processed to get information and data which would be of value to

Removing hide and blubber from a 650-pound sea lion at Ketchikan, Alaska.

A 650-pound sea lion with hide and blubber almost removed.

cold-storage and reduction-plant operators in estimating the economics of a sea-lion operation. The yield of meat, blubber, liver, and hide obtained from animals of varying size and sex are reported in table 1.

Table 4 - Proximate Composition of Sea Lion Mammary Tissue from a Nursing Cow and of Sea Lion Blubber

Analyses	Mammary Tissue	Blubber
	(Percent)	
Moisture	40.7	16.0
Oil	48.4	78.8
Protein	11.6	5.0
Ash	0.9	0.2

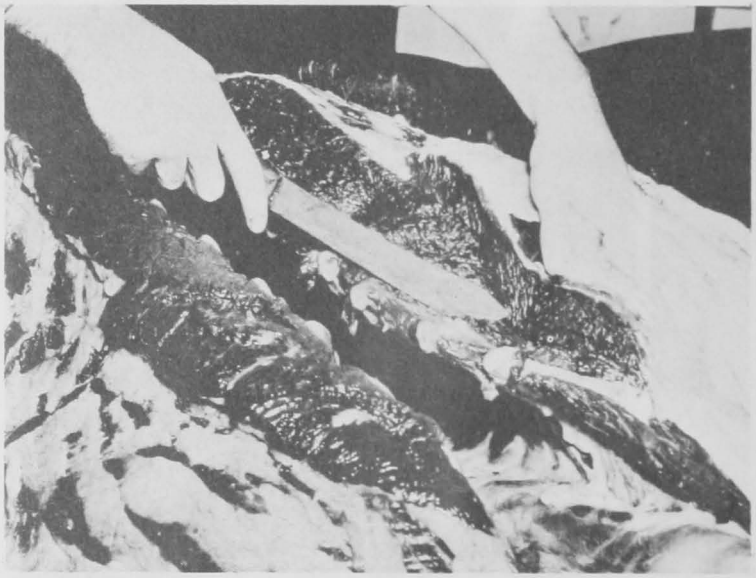
The data indicate significant differences between individuals, but roughly 33 percent of the carcass weight is meat, 12 percent blubber, and 6 percent hide. The liver, a fairly rich source of vitamins, is large--almost 3 percent of the carcass weight. The meat reported is that which could easily be recovered in butchering. Most of the "fat-free" meat comes from the neck, foreflippers, and brisket where the meat is 4 to 6 inches thick. This meat was cut free of bone and blubber,

packaged in polyethylene bags and frozen for mink-feeding studies at the Experimental Fur Station, Petersburg, Alaska. Analysis of the meat indicated a much

Table 5 - Some Physical and Chemical Constants for Sea Lion Blubber Oil and Viscera Oil and Fur-Seal Blubber Oil

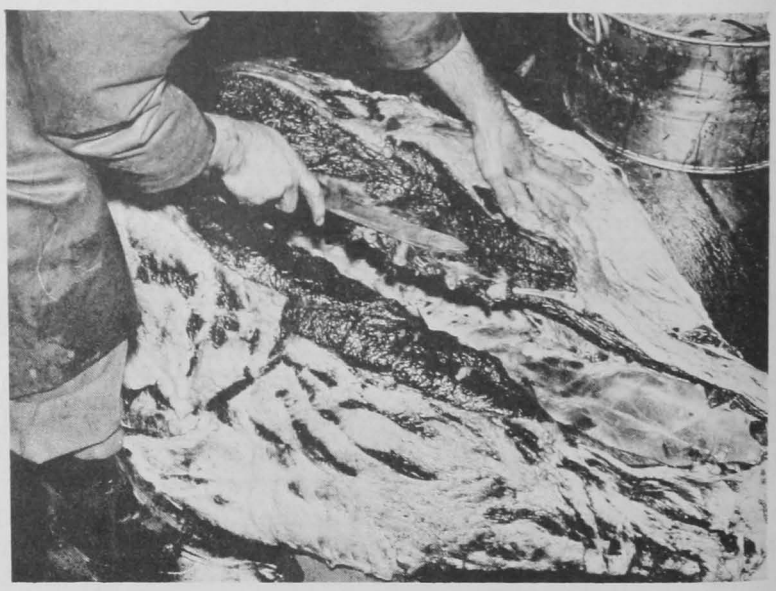
Analyses	Sea Lion		Fur-Seal
	Blubber Oil	Viscera Oil	Blubber Oil
Specific gravity 25° C. ...	0.9208	0.9175	1/ 0.9254 (60° F)
Iodine value	136.9	139.4	2/ 137.3
Saponification equivalent ..	181.1	187.3	1/ 181.2
Unsaponifiable matter.....	1/ 1.4	-	2/ 0.4

1/ Bailey, Carter, and Swain (1952).
2/ Data for 1954 fur-seal oil produced on Pribilof Islands. The data were obtained from the general manager of the Pribilof Islands in a personal communication.



Butchering a 650-pound female sea lion. Meat thickness on brisket is 4-6 inches.

higher fat content (8-13 percent) than the 2.5 percent reported by Dassow (1955). This higher fat content was probably the result of two factors: First, to remove all the blubber when skinning demands more care and time than would be practical for a commercial operation; second, portions of the meat had a higher fat content than the particular dark lean tissues sampled by Dassow. Fur farmers seek a feed with low fat content because unsaturated acids in fats quickly become rancid. The deposit of rancid fat in the tissue of mink and other animals is associated with "yellow fat" disease. The fat is not so objectionable in fish-hatchery feeding. Methods of producing meat of lower fat content will be investigated. This might be accomplished either through different butchering techniques or by selecting for these market outlets those sections of the carcass in which the oil content of the meat is low.



Meat on brisket of 650-pound sea lion is 4-6 inches thick.

MEALS

To determine the proximate composition and protein quality of meals that might be produced from sea lions, the entire carcasses (except the hide and blubber) of animals 1 and 2 were separated into fractions and dried to meals. The meals were prepared by grinding the fraction into pieces $\frac{1}{4}$ inch or less and then drying in circulating air at a controlled temperature of 150° F. The viscera was cooked, to aid in handling, for 20 minutes at 240° F. before grinding. The proximate analyses of these meals are shown in table 2.

Removing lean meat (to be used for mink feeding tests) from sea lion carcass at the Fishery Products Laboratory, Ketchikan, Alaska.

The viscera meal included all of the viscera except the liver, which was treated separately, and the stomach and sex organ which were saved for biological study. The bone meal includes all of the bones from which the meat had been removed, together with the head and flippers with their attached hide and blubber. The meat meal was representative of the bone- and blubber-free meat.

The results of chick-feeding tests at the University of California indicated the liver-meal protein to be of good quality (comparable to the best fish meals) and the viscera-meal protein to be of fair quality. The other meals have not yet been evaluated by chick-feeding tests.

PROXIMATE COMPOSITION OF CARCASS

From the proximate analyses of the liver meal, viscera meal, and bone meal and representative samples of the meat and blubber, the following proximate composition of the whole carcass (less hide) of sea lions 1 and 2 was calculated. This proximate composition, together with a proximate composition of herring for comparison, is shown in table 3.

The oil content of these sea lions is high. The seasonal variations in the composition of sea lions is not yet known. Fishermen report bull seals to have a particularly thick layer of blubber when first seen on the rookeries in late May. Perhaps this store of blubber sees them through the fasting of the breeding season. If this is so the fat content of the animal would vary considerably with the season of capture.

Sea lion 4 (table 1) was carrying a well-developed fetus (6 pounds) and, in addition, had well-developed milk-secreting mammary tissue extending through the blubber from the foreflippers to the tail flipper. This mammary tissue weighed

26 pounds or approximately 40 percent of the total blubber weight. This animal might be similar in composition to the females recovered from rookeries during the mating season. The proximate composition of the mammary tissue is compared with that of the blubber in table 4.

The calculated composition of a nursing cow is then 59.8 percent moisture, 20.0 percent oil, 17.2 percent protein, and 3.1 percent ash. As was expected, the cow showed a lower oil content and higher protein content than the immature animals whose composition is given in table 3.

Placing sea lion meat wrapped in polyethylene bags in freezer. Frozen meat was shipped to Petersburg, Alaska, for mink-feeding experiments.

OIL

Samples of oil were rendered from the blubber and from the viscera of the sea lions. Some of the chemical and physical constants of these oils are given in table 5. Fur-seal oil is included in the table for comparison. It is apparent that the chemical composition of these oils is very similar.

Table 6 shows the price paid early in September for seal, herring, and menhaden oil for the last five years.

Fur-seal oil follows the general trend of fish-oil market prices. However, since it finds a special market in the leather industry, in two of the last five years it brought a premium price above fish oils. Similar trends might hold true for predicting the market value of sea-lion oil.

HIDES

The hides of sea lions produce on tanning a heavy-bodied leather which can be split to make a soft durable leather. However, the leather appears at this time to be of no commercial value because the hides have too many defects, e.g. cuts and scars (Dassow 1955). Investigation of new uses for sea lion hides is being carried out at this laboratory.

UTILIZATION OF SEA LIONS

Interest in utilizing sea lions has been keen, but no one has yet undertaken a commercial operation. The butchering and reduction of sea lions and hair seals might be attractive to a herring reduction plant operator during periods when the herring fishery was closed. This would be true particularly during the time when the quota for the first half of a season had been met and before the second half of the season opened. In addition, an operator with cold storage facilities as well as reduction plant equipment might find butchering sea lions a profitable way to utilize idle plant capacity. The meat so preserved might be sold for fur animal or fish food at a better price later in the season.

SUMMARY

Sea lions are predators on the commercial fisheries of Alaska causing continuing financial loss and annoyance to the fisherman. A good way to control a predator is to find a commercial use for it. Investigation indicated a number of small sea-lion

rookeries in southeastern Alaska within one day's run of existing cold-storage and reduction plant facilities. Under certain conditions the handling of sea lions by these plants might be attractive.

Table 6 - Price the First Week in September for Fur-Seal, Herring, and Menhaden Oil, 1951-55

Year	Average Market Price in Cents/Pound		
	Fur-Seal Oil 1/	Herring Oil 2/	Menhaden Oil 2/
September 1955	9.50	8.25	7.75 - 8.25
" 1954	7.80	8.00- 8.50	7.75 - 8.00
" 1953	7.60	7.25- 7.75	6.125- 7.00
" 1952	6.90	6.75	6.50
" 1951	13.10	10.00-11.00	10.00 -10.50

1/ Selling price in Seattle of fur-seal oil produced on Pribilof Islands. This oil is usually marketed early in September. The prices were obtained from the general manager of the Pribilof Islands in a personal communication.

2/ Data obtained from the daily "Fishery Products Market Report," Market News Service, U. S. Fish and Wildlife Service, Seattle, Wash.

Seven sea lions were caught near Ketchikan, Alaska, in December 1955, and January 1956. From these animals the yields of meat, liver, blubber, and hide were determined and the proximate composition of an immature animal and a nursing cow were calculated. The oil rendered from sea-lions was found to be similar in chemical composition to fur-seal oil, an oil which usually follows the market price of fish oils, but in some years brings a premium over fish oils.

The meat from sea lions comprises about one-third of the carcass weight and might find a market in fur-animal or fish-hatchery feeding, competing with whale and horse meat. No commercial use has yet been found for the hide.

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CHITIN THREADS FROM LOBSTER SHELLS

It is stated that a method for preparing crude chitin in good yields from lobster shells has been developed by combining the most attractive features of the conventional methods. The limited experiments carried out at the Fisheries Experimental Station, Halifax, N. S., Canada, are reported to have indicated that chitin threads can be produced easily from lobster shells.

--Trade News, January 1954