

industry. There is a constant transfer of activities to more profitable branches of the industry, thus bringing all branches to the saturation point. This is a situation foreseen by leaders in the industry. As this condition becomes more generally recognized, it is a reasonable assumption that those charged with the responsibility of administering the fishery resources of Canada, will take the necessary steps

to recapture the former trade in dried fish and thus pave the way for profitable operations throughout the entire industry.

No attempt has been made here to deal with the social or human aspects of this problem which so gravely affects the livelihood and welfare of many thousands of our inshore fishermen who have no other means of employment.

Recent Developments in Processing Fish

By D. B. FINN

"And they went down to the sea to fish".

FROM time immemorial men have gone down to the sea to fish with simple gear and simple methods. The years have not brought a great deal of change. Increased effectiveness or radical improvement in catching has been discouraged rather than encouraged because fishermen did not wish to see their gear outmoded and because of legislative restriction in the interests of conservation. Thus, all our more important fisheries depend upon one or other of the methods of spearing, harpooning, single-hooked lining, multi-hooked long lining, gill netting, seining, trapping or trawling, these latter two often being restricted by government regulation.

It is in handling the fish after they come from the water that improvement can most readily be noticed. Naturally the foremost effort is that of preventing of deterioration in this product which spoils so rapidly. Various ways are chosen but nearly all of them depend upon keeping the fish cool by placing them as soon as possible in crushed ice. Sometimes the fish is cleaned before stowing, as with cod and haddock and sometimes, where the time between catching and landing

at the wharf is short as with the Atlantic inshore vessels or with the Pacific salmon boats, they are not cleaned until they are in the fish processing plant where the operation is often done at unbelievable speed by machinery.

Here we must digress for a moment from the sequence of description in order to say something about the factory ship because it is in this rather complex implement that efforts to stabilize quality reaches its zenith. A factory ship is one which not only catches the fish but processes it on board immediately after catching. Several such vessels are operated from European ports. Some countries send them to the Grand Banks for cod and haddock, others to Greenland for halibut and recently the Japanese have sent floating canneries to the Canadian Pacific and Alaskan coasts. These vessels, which are almost the size of a large liner, are equipped with a number of smaller boats which do the actual fishing. The Mother ship is equipped with up-to-date freezing apparatus and well constructed cold stores. All the waste from the processes is gathered and turned into fish meal and oil. Perhaps some of the cargo is salted to be manufactured when the vessel once again reaches port, the period of which is sometimes six months from the beginning of the venture. It may be only a matter of time before this method of handling

EDITOR'S NOTE: D. B. Finn, M.Sc., Ph.D., F.C.I.C., is Director of the Fisheries Experimental Station at Halifax and Associate Professor of Biochemistry at Dalhousie University. Last year he contributed another article to this journal "The Fisheries and Science". *Public Affairs I*, p. 51.

fish is widely adopted, with perhaps serious results upon our export markets. It is certain that the artificial stimulus of economic nationalism is tending in that direction.

Such methods are not quite as necessary particularly for the industry in Eastern Canada because it is fortunate enough to be situated very near to rich fishing areas and can therefore land its fish quickly at the land factories or plants where they can be processed more cheaply than at sea.

This brings us to the shore where the effect of modernization is further noticed, especially in some branches of the industry. Of course the industry has a long way to go before it achieves an adequate measure of improvement. The word improvement is used in the sense of meaning the production of a more uniform product of stable quality at a lower production cost. This of course means that waste through deterioration or non-utilization of the product must be held to the minimum. Only in this way can fish stand up against its chief competitor, other food products.

In North America and indeed many other parts of the world, people have been trained in their food preferences by food industries other than the fish producing industry. These preferences are definitely for packaged foods which can be easily distributed and consumed. The fishing industry finds that it must conform to this preference and follow what has become the modern trend if it is to maintain or increase its markets, which in Canada, at least, are small and capable of further development.

This is largely why the use of machinery is gradually displacing hand labour for it is found that modern machinery rules out the variable human factor, and therefore produces a more uniform product at greater speed. Speed of handling is all essential for fish because it deteriorates so rapidly.

To see the use of machinery one has only to turn one's eyes to the huge Pacific coast canneries. Here the fish are unloaded from the vessels by automatic

conveyers, they are split, cleaned and finned by a machine, the "iron chink",—so-called because it replaces the Chinese labour which was formally used. From this machine they travel on moving belts into a cutting machine and from there to another machine which place them into cans at the rate of one hundred and twenty-five per minute. In this way the canneries are able to produce annually over one million five hundred thousand, forty-eight pound cases during the short fishing season of about three months. On turning to the east we see a machine which cuts fillets from cod and haddock. It can handle fish from 1.5 to 10 pounds, and the yield per fillet per fish is ten per cent higher than when hand methods are used. When fillets are cut by hand, it takes about 270 pounds of round fish to make 100 pounds of fillet, the filleting machine produces 100 pounds of fillet from 208 pounds of round fish, and operates at a speed of about 50 fish per minute. Here we have speed, uniformity, the saving of raw material and lower costs. It is not being used in Canada at the present time but if its use becomes prevalent in countries that are competing with Canada, it is only a matter of time before we shall be forced to use it, or a similar machine.

After the fillets have been cut, they may be marketed without further processing or they may be smoked or frozen. The modern tendency is towards wrapping each fillet individually either by hand or machine. If they are to be sold in the unfrozen state, they are placed in boxes which are surrounded by crushed ice and shipped in cooled express cars to the wholesale center. The percentage of fillets marketed in this way is diminishing, an increasing number of them being frozen first. The freezing of fillets and of packaged products presents another problem to the industry for not only have they to be rapidly frozen by new techniques but they have to be stored at below zero temperatures which must not vary. These necessities have led to the design of freezing machines and the building of special cold storage warehouses.

Such frozen material is shipped in refrigerator cars which are held below the freezing point. A great deal of research has been done by the Fisheries Research Board and the Railways of Canada with the object of improving refrigerator cars. Notable success has been achieved and it is now possible to send frozen fish across the continent without serious deterioration even during the warmest summer months. Of course it is necessary that the wholesale warehouses be similarly equipped with storage space especially designed to hold these low unfluctuating temperatures because one set of wrong conditions will set at naught all the care that has gone before. Progress is being made in this direction although there is still much to be done. Similarly, special low temperature show cases are necessary for retail stores. Show case manufacturers have addressed themselves to this problem and are making headway.

The growing preference for frozen fillet as compared to unfrozen fillet is due to a superiority in the freshness of the former. This in turn is due to the fact that when material is properly frozen and stored its state of freshness is fixed and stabilized at the instant of freezing. Therefore when the consumer gets it, it may be much fresher than the unfrozen fillet which even though it is stored in crushed ice is constantly deteriorating.

The dried salt fish industry which has suffered so much from trade depression and adverse trading conditions quite external to the industry itself, is a good example of one which is entirely dependent upon the vagaries of the weather for the uniformity of its products, and we have good reason to know how extremely variable that is. Ordinarily the salt fish is dried on flakes in the open air. When the wind is cool and dry success attends the venture, but if the air be moist, that is, when the relative humidity is high, or when the sun is too hot, the fish spoil unless they are quickly removed from these adverse conditions. This means that the labour per pound of fish dried is very high and that the

product is anything but uniform in moisture content and quality.

No one has yet been able to control the weather, but so far as drying is concerned, many industries have long been independent of it by using artificially conditioned air in special drying machines. Recently the laboratories of the Fisheries Research Board have succeeded in finding out the air conditions which are necessary for the manufacturing of dried salt fish. Thus it is possible for this industry to become independent of uncertain weather with the concomitant assurance of lower percentage of loss and a uniformity of result. Ultimately the cost of operating such an apparatus, reckoned on the cost per pound of fish dried, will be reduced to the point where the capital investment will be justified wherever, and whenever large quantities of fish are to be treated. Indeed, it gives promise, for certain kinds of fish at least, of lower costs than those realized by old fashioned methods.

The growth of the by-products of the fishing industry is almost entirely due to the invention of certain mechanical devices for turning the waste into something useful and valuable. Thus although the virtue of cod liver oil was known for a long time, it was not until superior refining methods were available that its volume of production increased. The discovery of the high vitamin concentration of halibut, swordfish and tuna liver oil would have been of no avail unless it were for the modern methods of solvent extraction of the oil contained in these livers. This has made valuable products possible from that which was formerly valueless. Work on the chemistry of these oils has made it possible to separate the vitamins themselves from the oil which contained them, and has given rise to the very well known "Vitamin Concentrate Industry".

Other processes have made it possible to turn the trimmings from fresh fillets into a valuable source of protein for the feeding of farm animals. The fillet trimmings and other parts of the fish are cooked with steam under pressure in large cylindrical drums. The cooked

material is then conveyed to another machine which evaporates all the water. The dry material is then ground to the consistency of coarse whole wheat flour, a substance which it somewhat resembles in appearance and colour. This operation usually takes place the same day that the fillets are cut so that the meal is just as fresh as the fillet itself and has none of the unpleasant odour which is usually associated with stale fish scraps. In former days most of this waste was either thrown away or used for fertilizer, and it is the introduction of machinery which has made it possible to eliminate this loss.

Indeed it is safe to say that had it not been for the by-products together with the introduction of modern tech-

nical and mechanical methods the fishing industry would not have survived even to the extent that it has in the world of to-day. It has still a long way to go before it will be on an even competitive footing with other food industries. It has many difficulties to overcome, perhaps difficulties greater than have been faced by the farmer or the meat packer and many another who deals with less perishable material. The solution of these problems will lie largely in the direction of more complete technical control over its manufacturing, storing and distributing methods. This control will come as it mechanizes its processes, a movement which is already under way and which brings in its train a series of social and politico-economic problems.

Nova Scotia Coal Industry and Freight Rate Subvention

By DONALD B. WALLACE

THE mining of coal is one of the oldest and most important of Nova Scotia industries. With a physical plant investment of approximately \$50,000,000, a working force of 13,000 workers, and an annual output valued at \$23,000,000, this industry now produces 45 per cent of the total coal mined in Canada. Also, the combination under one corporate head of the allied productive processes of coal mining and steel production, makes the Cape Breton area the steel centre of Canada.

While coal is a factor of major economic importance in the province, it must also be considered as having a definite correlation with the economy of the nation as a whole. The gradual emergence during the past decade of a national fuel policy has given an added impetus to

the industry, and, at the same time, has created a situation wherein coal and politics have largely become synonymous. Thus the functioning of the Nova Scotia coal industry in recent years constitutes a striking example of the manner in which a basic national industry, situated at the extreme eastern tip of Canada's strip economy, has tended, through the medium of Federal transportation subventions, to equalize burden and advantage as between producer and consumer in the national interest.

Admittedly, the fuel situation in Canada is somewhat anomalous, for, in spite of enormous potential reserves, about 50 per cent of the consumption is imported, largely in the most important consuming centres of Ontario and Quebec, as these two provinces are far removed from the Nova Scotian fields in the East and those of Alberta in the West. Therefore, the Dominion Fuel Board was creat-

EDITOR'S NOTE: Donald B. Wallace, M.A., is a graduate of Acadia and the University of Toronto, and is engaged as Assistant Special Representative, Canadian Pacific Railway, Montreal.