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CONTENTS

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WHITEBAIT DEPLETION AND WHITEBAIT CONSERVATION

(Based on information supplied by Mr A. E. Hefford, late Chief Inspector of Fisheries)

The vast abundance of whitebait in the early days of European settlement seems to be an item in the history of almost every New Zealand river. The runs of whitebait are still of sufficient abundance in many of our rivers to be of definite commercial importance. For example, it was estimated that in 1932 at least 4,000 cwt. of whitebait, which would represent over 400,000,000 individual fishes and would bring in to the fishermen not less than £20,000, were caught in the Dominion. Since then the total landings of whitebait have fluctuated between 3,250 cwt. and 1,837 cwt. These figures are only approximate estimates but are sufficiently correct to indicate the commercial value of whitebait fishing in recent years.

Though no quantitative records or statistics are available, it is safe to say that in any year in the 19th century the highest total given above could easily have been exceeded. All old settlers can tell of the numerous runs of whitebait they knew in their childhood when bailing out from the river in buckets provided all the whitebait they required for their own substantial meals, and when whitebait was commonly used as feed for poultry and pigs. It is an outstanding example of depletion of a form of New Zealand wild life and of a problem to be solved by conservational measures.

The first thing to determine is what have been the factors responsible for depletion. The answer to this question is to be found in an understanding of the life history of the species which is also true of any problem of wild life depletion. There is really no one cause of depletion but rather a combination of several adverse factors of varying degrees of potency. The effect of any one factor may also vary from time to time, so that the elucidation may call for investigation continued over several years.

The question of the reduced stocks of whitebait has one factor in common with the problem of the deterioration of many other fisheries in the Dominion. The general cause has undoubtedly arisen from the settlement of this country by Europeans. There are several particular factors, commercial exploitation of increasing intensity being only one, arising from the changes brought about by European settlement which have affected the ecology of the species **(Galaxias attenuatus)** in special ways. It is by no means

safe to assert that greatly intensified fishing is the main cause of the depletion, though thousands of nets made of mosquito netting woven in Lancashire or wire gauze fabricated in Birmingham are operated every season and, as mentioned above, may account for the abstraction of as many as 400,000,000 individual fishes from one generation of the species. The fecundity of most fish species is such however that it provides for an enormous degree of mortality in juvenile stages; and whitebait is only a juvenile stage of inanga. A single female inanga of average size produces about 4000 to 5000 eggs at one spawning and may spawn two or three times during life.

The life history of **Galaxias attenuatus** is briefly as follows: One may begin conveniently at the whitebait stage since it is at this stage that they are best known. Whitebait ascend many New Zealand rivers in considerable shoals, running in from the sea, chiefly during the spring months. They may appear as early as June or as late as January. At this stage a whitebait has a translucent glassy appearance which is the usual condition for post-larval fishes, especially those living in the sea. As the whitebait ascend the river they become opaque and the development of the pigment in the skin rapidly extends. They have now begun to feed on small fresh-water organisms, such as insect larvae and crustaceans, though during their migration from the sea they were undergoing a fast and their alimentary canals were entirely devoid of food. They tend to make for slow-flowing or stagnant water, the largest inanga populations being found in lakes and lagoons and in drainage channels. After approximately six months of fresh-water life the inanga may become sexually mature. As the gonads ripen the fish descend to tidal waters generally moving in schools of appreciable size. During this migration they were formerly trapped in great numbers by Maoris for whom they provided a useful fish food supply. This Maori fishery is still carried on in some places. They always descend on a spring tide (i.e., a day or two after new or full moon), and when the highest tide in the series has been reached they spawn either on that tide or on the next.

The inanga seek the margin of the water at the highest point of the tide when it has encroached on what is normally (except at the high spring tides) dry land on the river bank. Here among grass, clover or similar herbage the eggs are deposited and fertilised. As the tide ebbs the fish swim back to the stream and return to their fresh-water habitat, leaving the ova, small spherules about the

size of a pin's head, of a translucent almost colourless jelly-like substance, adhering to the bases of the herbage submerged by water until the next spring tide. Sometimes this does not reach them and they may have to wait a full month or even six weeks on dry land. There they are safe from aquatic enemies and the thick cover of herbage chosen by the parents normally ensures that the eggs remain sufficiently moist to incubate. When the next spring tide reaches them the embryos are ready to hatch out: the shell membrane, softened by the water is easily ruptured and the larval fish, resembling a small pin about $\frac{3}{8}$ inch long, glassy clear in appearance except for its pair of black eyes, is carried away with the ebb tide and so into the sea. Its marine phase of life has not yet been investigated. The next stage we know is when it migrates back to the fresh water as the whitebait. This takes place about approximately half a year after the hatching. As mentioned above, whitebait runs may take place in any month between June and January, but the height of the run is about October-November, earlier in the North Island than in the South Island. Spawning may occur any month from January to June, but February, March, April, appears to be the height of the season.

It is not enough to be acquainted with the life history of the species as individual fishes. They must also be considered as a population if we want to get a sound basis for a conservation policy. The conservation problems of any aquatic species are the same in their general features. It is a matter of revealing the items in Nature's balance-sheet which make on the one hand for additions to, and on the other hand for subtractions from the population or stock. In other words, sound conservational policy must be based on an understanding, quantitative as far as possible, of the biological and ecological factors that affect increases or decreases in the numerical abundance of the species. These may be stated in general terms which will apply to any species of animal or plant as follows:—

(A) Those which make for increase in growth:

1. An environment that affords a safe habitat with an adequate food supply for the species throughout life.
2. An environment that is favourable for fecundity and successful production of offspring.

(B) Those which make for decrease in growth and for mortality:

1. Lack of food at any stage which will diminish growth, reduce fecundity, retard or prevent repro-

duction (may be caused by presence of food competitors as well as by deficiency of food organisms).

2. Other inimical circumstances, which may be physical, and that adversely affect reproduction and growth.
3. Presence of active predators which may be carnivorous animals but which now include man, often in this age the arch-enemy and predator-in-chief.
4. Disease due to the action of pathogenic organisms.

A fish fauna may be subject to any or all of the above.

In the case of whitebait the suitable habitats of the species have been considerably reduced. Swamp pools, lagoons and extensive shallows that are often part of a river system under original natural conditions have been removed or reduced by drainage operations or by the construction of embankments. The effect of soil erosion is to bring about abnormally low water conditions and floods which have to be provided against by engineering operations which themselves reduce the availability of inanga habitat. Pollution from various industrial sources has altered, if not poisoned, the bottom of streams which thus no longer produce their former abundance of organisms suitable for inanga food.

One may sum up under this heading by stating that habitats providing feeding grounds and otherwise suitable environment for the species have been greatly reduced in extent and have deteriorated in quality to varying degrees by the works of civilised man operating directly or indirectly (comparable with the destruction of bush in its effects on, say, the pigeon fauna).

When we come to consider propagation (spawning) the effects of civilised settlement are equally, and possibly much more, inimical to the species. Where once the inanga spawned—one can visualise the sort of riparian scene from what has been said above—one may now frequently find an artificial embankment practically devoid of any vegetation with perhaps a river-side traffic road or, more usually, a paddock close-grazed by stock to the water's edge or a row of willows or some other exotic trees. Or where a tributary stream originally had a considerable area of shallow water at its junction with the main river over which the spring tides could spread out and submerge the adjoining expanse of grass or reeds, one usually finds nowadays that the land-owner has converted the stream into a tiny and confined channel that keeps its waters where in the owner's view they ought to be, not spread out on his land. All these modifications, brought about by settlement, repre-

sent losses of spawning accommodation for the whitebait species.

In considering the several inimical factors that may operate, one may conveniently commence at the egg stage. The deposit of spawn so that it remains for the period of its incubation out of reach of aquatic predators is a remarkable and almost unique provision of Nature for the prevention of ova losses. There could have been relatively few agents of interference under primeval conditions; but under present conditions cases of ova destruction have come under notice that have been due to:—(1) Floods covering eggs with a smothering deposit of silt (erosion effects); (2) Eggs trampled by cattle, horses and humans; (3) Eggs killed by use of chemical weedkiller by a drainage board; (4) Spawn destroyed by weed-clearing and bank cleaning operations.

The marine phase, which presumably lasts from about four to six months, must be subject to very considerable losses by predators which devour the young fish, or possibly there may be conditions under which the larvae (now constituents of the marine plankton) may be carried by adverse currents to bodies of water where suitable food supplies are deficient and where, therefore, there will be augmented mortality. This is the sort of thing that may happen to any pelagic fish larvae or post-larvae and is quite probably a major factor in causing fluctuations in abundance from year to year. At the whitebait stage the species has been found among the stomach contents of marine fishes. It is possible that the reduction of marine species by commercial fishery operations has diminished the number of enemy predators and thereby been of assistance to the survival rate of whitebait. Under natural conditions whitebait are preyed upon by fishes in the sea, in tidal waters and in fresh waters. Fish such as the yellow-eyed mullet or so-called herring (Agonostomus) and the introduced trout, and also salmon, figure among their important enemies. At this stage of entry into fresh water it is undoubtedly the commercial fisherman who takes the greatest toll. Various forms of restrictions are applied by regulations under the Fisheries Act such as prescribing a close season (in the North Island last half of November to June inclusive, in the South Island last half of December to July inclusive), limiting and regulating the size and kind of nets to be used and limiting the degree to which accessory devices may be used. In spite of all this there is an enormous abstraction from the numbers of whitebait runs as a result of fishery operations.

Probably the most potent factor in conserving the whitebait in the face of excessive exploitation is the incidence of flood and bad weather conditions which prevent fishing and give the fish a chance to ascend to its fresh-water habitat. Fortunately, soon after coming into fresh waters the fish begin to feed and lose their transparency and typical "whitebait" appearance and at this stage they are not sought after for the pot or the fishmonger's shop. Even in connection with fishing the whitebait are subject to handicaps as the result of human artifacts in that their progress is checked by such obstacles as weirs and sluice gates so that they fall easy victims to the fishermen, or they may be led to destruction by entering man-made drains or irrigation ditches.

The inanga stage is reasonably safe or as safe as it has always been, when once it gets to its fresh-water habitat. As already indicated the extent of available habitat has been much reduced following civilised settlement and colonisation, and in some cases waters formerly suitable for inanga have been rendered more or less barren as the effect of pollution. (For many years the anti-pollution regulations only applied to streams into which salmon or trout had been placed. The pollution law is frequently difficult to administer in practice and has never been rigorously enforced everywhere.)

In some places there are Maori fisheries for the descending adult inanga. These operations must diminish the total quantity of spawn deposited and hence the potential "head" of whitebait which represent the survivors from the marine phase of post-larval life history. To what extent whitebait return to their natal stream or are subject to mixing of communities and diversion to other than their natal streams is a matter about which nothing is known. It seems probable that one river's whitebait run may have originated from ova spawned in some other river. Some day plankton investigations in the sea will throw light on this question.

The problem for the administrator of a conservational policy regarding whitebait is to see that the utmost use is made of available inanga habitats and even to consider the question of adding to them. It is, however, of no use producing a large population of adults unless suitable spawning ground is available, and therefore this provision should also receive attention.

Things to Do:

Map the spawning grounds of the inanga in your district.

Suggest alterations in land utilisation which would increase the number of larval fish hatched and improve the conditions for the adult fish.

Discuss the effect of the aeroplane on the future yield of whitebait.

Plan a programme of whitebait conservation for (a) your district; (b) New Zealand.

ANIMAL PRODUCTION IN THE NORTH ISLAND

P. G. Stevens, Dip. C.A.C., Lecturer in Animal Husbandry

It is generally recognised that the North Island plays an important part in our dairy production, but I doubt if it is realised just how big this "important part" is. If we put it in figures we find that 87% of the cows in milk are in the North Island and that they are responsible for the production of 95% of our butter and 85% of our cheese. Striking as these figures are, they do not mean that the whole of the North Island is engaged in dairy farming—rather is it restricted to those districts which have a mild climate, a heavy and well distributed rainfall, with adequate summer rains together with low altitude and easy contour. Such areas are found in the Auckland Province—Northland, Waikato and Bay of Plenty—in Taranaki and in the Manawatu area of the Wellington Province. Of these areas Auckland is of special interest because of its rapid development during the past twenty years. Pasture improvement has resulted in this area carrying more than half the dairy cow population of New Zealand, and producing approximately two-thirds of our total butter.

Taranaki, the oldest and perhaps the best recognised of the dairying districts, has about 13% of the total dairy cows. It is noteworthy for its cheese production—about 40,000 tons, or 45% of the New Zealand output. This cheese production is a legacy of the development of its dairying at a time when prices favoured cheese production.

The Manawatu, with 10% of the dairy cow population, is border-line dairying country. The rainfall is lighter than the Taranaki and Auckland areas, though fairly well distributed; the soil is heavier and the winter less favourable. Such conditions allow fat lamb raising to compete successfully with dairying, and in the Manawatu dairy farms and fat lamb farms are found side by side.

The common feature of North Island dairying is the predominance of the Jersey breed. Initially the dairy herds were of the Shorthorn type but the use of Jersey bulls through successive generations has converted them into grade Jersey herds. The extent of this change, even

in recent years, will be appreciated by realising that in 1921, 56% of our dairy cows were Shorthorn and 30% were Jersey. By 1938 the Shorthorn figure had been reduced from 56% to 8% and the proportion of Jersey cows increased from 30% to 78%. In addition, of the bulls used in dairy herds during recent years, 75 to 80% were Jerseys.

This change in breed is not due to higher production on the part of the average Jersey cow, as the average butter fat production for each of the specialised dairy breeds is about the same; it is due to two characteristics of the breed—first, its small size, which enables more cows to be carried on a given area, and, second, its high butter fat test which is associated with greater economy of food requirements for each pound of butter fat produced.

From a practical point of view, these characteristics mean increased production of butter fat per acre, and these are precisely the lines on which the specialist North Island dairy farmer thinks.

The dairying areas of Northland, Waikato and Bay of Plenty are capable of much wider expansion. There is still a considerable area of unimproved land which is well suited for dairying, but its utilisation for this purpose will be governed by economic considerations and the supply of fertiliser. Even the so-called "bush sick" areas which for a generation defied investigators, are now farmed successfully with the aid of cobalt.

Pig raising is a feature of North Island dairy farming. The almost complete absence of cheap, locally grown grain ties the pig hard and fast to the dairy cow. It is the only means we have at present for converting valuable dairy by-products—separated milk, buttermilk, and whey—into a saleable product.

It is not surprising, therefore, that the distribution of the pig population follows very closely the dairy cow distribution.

The Auckland area is again to the fore with 58% of the breeding sows—Wellington, Manawatu and Wairarapa follows with 13% and then comes Taranaki with 9%. This low figure for Taranaki is a reflection of the cheese industry. Whey, the by-product of cheese, has only about half the feeding value of separated milk, and because of important deficiences in its composition, is much more difficult to utilise than separated milk.

The proportion of breeding sows in the North Island is approximately 88%—a figure which compares with the dairy cow figure of 87%. I hope that I have not left the impression that the North Island is a land of dairy cows

and pigs. As a sheep producer it is also of great importance.

The New Zealand ewe breeding flock numbers at present about 20½ million ewes. Of these, Auckland claims 15%, Poverty Bay-Gisborne 6% Hawke's Bay 14%, Taranaki 3% and Wellington 20%. A total of 58% of the ewe flock is found in the North Island. Despite this advantage in ewe numbers the fat lamb export trade is about the same for both islands. It fluctuates round about 5 million for each island.

The North Island fat lamb raising areas are not as clearly defined as the dairying areas, as a considerable number of fat lambs are raised in dairying areas in addition to the specialised fat lamb areas where little or no dairying is carried out.

Hawke's Bay, with plenty of easy, rolling country, but a light rainfall, is of little importance as a dairy producer, but is noteworthy for its fat lambs. A feature of its pre-war lamb trade was the selling of new season's lamb on the English Christmas market.

The Manawatu, already described as important in the dairy world, is equally important as a raiser of fat lambs, while Auckland is producing an increasing number each year. All of these areas rely almost entirely on grass-fattening, and specialise in milk lambs, that is, drafts of lambs straight off the ewes.

The Poverty Bay-Gisborne area, together with the less favoured hill country of the rest of the island, is the wool and mutton country, grazed by the flocks which breed their own replacements. These areas serve a useful purpose in providing each year cast-for-age ewes to the down country fat lamb raisers. Indeed, this service of providing a regular supply of breeding ewes might well be regarded as the foundation of the fat lamb industry.

The Gisborne ewes were at one time sold in considerable numbers in the Addington Saleyards each autumn. They now travel over-land to the Auckland area, and are the basis of Auckland fat lamb production.

The most striking features of North Island sheep farming are the dominance of the Romney ewe flocks on the hill country and the use of the Southdown ram by fat lamb raisers. Experience has proved the value of the Romney ewe under the heavy rainfall hill conditions, while recent wool surveys show that the coarse-woolled type developed in the North Island is the most profitable wool producer under these conditions.

The universal use of the Down ram by fat lamb raisers

is reflected in the export lamb grading system used throughout the North Island. The top grade is Prime Down Cross, and about 38% of the carcases manage to make this grade. The next grade is Prime Crossbred, which accounts for about 32%, while the remainder, about 30% are second grade.

The breeding of stud, or pedigree sheep is an important project in the Manawatu and Wairarapa districts. Approximately 36% of the registered Southdowns and 44% of the registered Romneys are in these districts. In the main, these flocks supply a large local demand for rams—Downs to the fat lamb raiser, and Romneys to the hill country man. However, such is the high reputation of the Romney rams produced that Romney stud breeders in all parts of New Zealand buy stud rams regularly in this area. The Feilding and the Masterton stud ram fairs held each January are highlights in the stud sheep world, and draw buyers from the whole of New Zealand.

Beef raising has always been of some importance—in most cases it is incidental to sheep raising; although there are still some unimproved areas devoted exclusively to beef, such areas are usually low-lying, wet and swampy, or subject to flooding. When improved, such land invariably becomes utilised for dairying. Most of the beef comes from the sheep country. The breeding herds are maintained on the hill sheep country where they have the job of pasture control. Some fattening is done on these areas but the bulk of it is done on the fat lamb farms. Formerly the whole of our exportable surplus was sent away as frozen beef, but as such was never popular on the English markets. In 1933 some improvement was made in this trade by exporting 20,000 quarters from young, high quality beasts chilled instead of frozen. These were well received on the English market and the trade has increased each year until in 1938, 237,000 quarters were exported.

It is not suggested that the North Island will ever be an important beef-exporting area. The job of cattle there is to keep the hill sheep country in order—to control the grass during flush periods and to prevent pasture deterioration by keeping fern and second growth in check. On much of the country heavy cattle are needed for the job and this means that on the average they are four years old before they reach the lowland grazier who fattens them. Such cattle are too old and too heavy for the chiller trade. The better class country would be excellent for high-quality baby-beef production but dairying gives greater cash returns and such land should continue to be the home of the dairy cow.

EFFICIENCY OF AGRICULTURE IN NEW ZEALAND

The following table is taken from a British Government publication "British Agriculture" issued in 1944.

Country	Value of Net Output Per Agricultural Worker	Number of People Fed Per Agricultural Worker
	£	
New Zealand	450	33
Australia	300	29
Great Britain	205	17
United States	185	13
Denmark	155	12
Canada	135	12
Netherlands	120	16
Belgium	100	9
Switzerland	100	7
France	90	5
Germany	70	7
Eire	65	6

Some of the factors affecting these figures would be the fertility of the soil, climate, ability to produce grass for the greater part of the year, amount of lime and fertilisers used, the standard of intelligence and of education of the worker, the degree of mechanisation, and State action designed to encourage farm production. A senior social studies or agriculture class might make a useful study by comparing some or all of the other countries with New Zealand with a view to finding the factors which have placed our workers at the top of the list.

GREAT FARMERS

3

Townshend

Born 1674; died 1738. Lord Privy Seal under William III. He served as a Commissioner to treat for the Union of England and Scotland; with Marlborough he signed the treaty at the Peace of Gertruydenburg in 1709. Under George I and George II he was Secretary of State, and Lord Lieutenant of Ireland.

In 1730 he retired to his estates of Raynham in Norfolk. He carried out experiments in the farming practices he had observed abroad, and devoted himself above all to the improvement of the rotation of crops and to the cultivation of turnips and clover. His land mainly consisted of rush-grown marshes or sandy wastes, where a few sheep starved, and two rabbits struggled for every blade of grass. The list of its produce included nettles and warrens. He

revived the ancient practice of marling the land. Farmers believed that "marl was good for the father but bad for the son" until he showed the fallacy. By the use of marl alone 400,000 acres of marginal land were made highly productive.

Following Tull, he drilled and horse-hoed turnips, and first popularised the Norfolk rotation: Roots, Barley, Clover, Wheat. The roots were fed on the ground by sheep and the light poor soils were consolidated and fertilised. Another part of the crop pulled and stored for the winter enabled the farmer to keep more stock. This enabled him to obtain more manure with which to enrich the land to produce heavier crops. Thus was verified the truth of the old proverb, "A full bullock yard and a full fold make a full granary." Farming in a circle, unlike arguing, proved a productive process.

Townshend received the name of "Turnip" because of his zealous advocacy of the crop as the pivot of agricultural improvement. Pope in his Horatian Illustrations refers to him,

"Of two brothers, rich and restless, one
Ploughs, burns, manures, and toils from sun to sun."

His efforts were richly rewarded. On the sandy soil, gorse-covered warrens were in a few years converted into tracts of well-cultivated productive land. Those who followed his example made fortunes. Many others did not follow his example, for a long time classing turnips as Hanoverian innovations, and refused their assistance with Jacobite indignation.—Summarised from "English Farming, Past and Present."

AN ELEVENTH COMMANDMENT

(Suggested by W. C. Lowdermilk, Assistant-Chief of the U.S. Soil Conservation Service)

"Thou shalt inherit the holy earth as a faithful steward, conserving its resources and productivity from generation to generation. Thou shalt safeguard thy fields from soil erosion, thy living waters from drying up, thy forests from desolation, and protect thy hills from overgrazing by thy herds, so that thy descendants may have abundance forever. If any shall fail in this stewardship of the land thy fruitful fields shall become sterile, stony ground and wasting gullies, and thy descendants shall decrease and live in poverty or be destroyed from off the face of the earth."

MAN AND LAND

It is strange how so few of our great men—our historians and economists, scientists and professional men,

statesmen and teachers—have recognized the full economic and social impacts of unrestrained soil depletion and unwise use. The ancients knew about the problem, and in various parts of the world their conservation efforts are extensively written on the ground in the form of rock-supported terraces or the remnants of engineering structures employed in their agricultural operations. But these records have not been written into our histories, not even in our volumes on economics and agricultural techniques.

Too generally, public statements about the causes and cures of world tribulations contain too little about the orgy of waste that began in ancient time and brought on repeated misunderstandings, raids and wars between neighbours and communities and between regions and peoples. It is my belief that our leaders through the ages have missed something. They have overlooked the greatest fundamental force for good—for good to all the people of the world. Seemingly they have left out of their considerations the fundamental significance of productive land—its utter indispensability to the welfare and brotherhood of mankind.

Working out on the land with many kinds of people and appraising the relation of productive soil to the welfare of the farmer and general public, my years of experience studying the lands of the United States, Central and South America and South Africa, have led me to the belief that men come to a better understanding of one another under such surroundings and circumstances. Out on the land there seems to be a kind of common denominator that influences men, that awakens a common conception of the close relationship existing between man and Nature, or the complete dependence of man upon Nature—upon productive soil, the mother of us all.—H. H. Bennett in "Soil Conservation."

Soil erosion of itself seems simple and easy to understand. But the problem of bringing it under control and re-establishing a natural balance under the conditions imposed by a complete civilisation, demands knowledge and techniques which touch on many fields of learning, and a co-ordinated approach to situations as involved and intricate as life itself.—H. H. Bennett to Congressional Committee, 1934.

THE CONSERVATION OF HUMAN RESOURCES

The human material is overwhelmingly the greatest of our assets. This material we believe is fundamentally good. It is produced in very uneven amounts in different geographic regions and under different social conditions. Almost invariably the largest supply tends to be produced

where the geographical and social conditions are least favourable. Contrast this with our farming procedure. We recognize that wheat should be produced where the climate is well adapted to it and where grain of high quality can be raised. We recognize that the best seed should be used; the more valuable the crop, the more important it is to have good seed. We recognize that the larger the amount produced, the more necessary it is that the best methods of production should be employed.

In respect to human material, we pursue the opposite course, for we have not yet learned the most elementary lesson of human conservation. The regions which produce the largest crop of children are the very ones where the conditions of health, education and social betterment are least favourable. Yet from these less favourable regions poorly trained young people pour into the cities each year to fill the places left vacant in the cities and in the more prosperous parts of the country because the supply of human beings is too small.

For their own sake, if for no other reason, it would seem as if the cities ought to show far more interest in improving the rural and less-favoured regions from which they draw so much of their human material.—Huntington.

BOOKS FOR THE HORTICULTURAL LIBRARY

Compiled by N. Lothian, N.D.H., Lecturer in Horticulture

The following books would provide a school or class reference library for the School Certificate syllabus in Horticulture. We would be pleased to suggest titles on special subjects in which teachers might be interested.

DICTIONARIES		
Fraser J. and Hemsley (editors): Johnston's Gardening Dictionary, Routledge	1917	32/6
or Macself, A. J. (editor): Sander's Dictionary of Gardening, Collingridge	1945	16/–
Johnson, A. T.: Plant Names Simplified, Collingridge	N.D.	6/–
GENERAL HORTICULTURE		
Coutts, J. and others: Complete Book of Gardening, Ward, Lock & Co.	1938	14/6
Middleton. C. M.: Mr Middleton suggests Ward Lock & Co.	1940	13/6
Lawrence, W. C.: The Young Gardener, Allen & Unwin	1945	6/–
McPherson, J. A.: The Complete New Zealand Garden. Whitcombe & Tombs	1945	6/6
Biles, R. E: Garden Magic, Ferguson, Chicago	1944	24/6
LAWNS AND PLAYING FIELDS		
Dawson, R. B.: Practical Lawn Craft, Crosby Lockwood	1945	25/–
FLOWERS		
Hottes, A. C.: Book of Perennials, De La Mare, New York	1942	13/6

Hottes, A. C.: Book of Annuals, De La Mare, New York	1942	10/3
Macself, A. J.: Bulbs and their Cultivation, Collingridge	N.D.	4/6
ROCK GARDENS		
Jenkins, E. H.: The Rock Garden, Country Life	1939	12/6
or Edwards, A.: Rock Gardens, Ward, Lock & Co.	1942	12/6
HYDROPONICS		
E. Hilyer, C. I.: Food Without Soil, Pelican		1/6
or Phillips, A. H.: Gardening Without Soil, Pearson	1941	6/-
TREES AND SHRUBS		
Makins, F. M.: Identification of Trees and Shrubs, J. M. Dent	1944	25/-
Osborne, A.: Shrubs and Trees for the Garden, Ward, Lock & Co.	1933	45/-
PROPAGATION		
Kains and McQuesten,: Propagation of Plants, Orange Judd	1939	31/6
FRUIT, VEGETABLES AND HERBS		
Bagenal, N. B.: Fruit Growing, Ward, Lock & Co.	1945	33/-
Bush, Raymond: Tree Fruits (2 vols.), Penguin S-132, S-138	1944	ea. 1/6
Bush, Raymond: Soft Fruits, Penguin, S-119	1942	1/6
Edmunds, A.: Espalier Fruit Trees, Horticultural Press	1945	5/-
Shewell, C. W. E.: "Thomas Smith" Profitable Culture of Vegetables, Longman, Green & Co.	1945	21/-
Hewer, D. G.: Practical Herb Growing, Bell & Son	1944	6/-
or Grieve, M.: Culinary Herbs and Condiments, Hein	1933	8/6
SOILS AND MANURES		
Whitehead, S. B.: Gardeners' Earth, J. M. Dent	1945	12/6
Bruce, J. A.: Commercial Fertilisers, The Orchardist, N.Z.	N.D.	3/6
Wild, L. J.: Soils and Manures in New Zealand, Whitcombe & Tombs	1946	4/6
Lawrence and Newell: Seed and Potting Composts, Allen and Unwin	1943	6/6
PESTS AND DISEASES		
Evans, J. W.: Insect Pests of Tasmania, Government Printer, Hobart	1943	2/6
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