The COMMON BUT LESS FREQUENT LOON AND OTHER ESSAYS

Keith Stewart Thomson

Illustrated by Linda Price Thomson

The Common but Less Frequent Loon and Other Essays

Keith Stewart Thomson

Illustrated by Linda Price Thomson

YALE UNIVERSITY PRESS

NEW HAVEN AND LONDON

Published with assistance from the foundation established in memory of Amasa Stone Mather of the Class of 1907, Yale College.

Set in Adobe Garamond type by Keystone Typesetting, Inc. Printed in the United States of America by Vail-Ballou Press, Binghamton, New York.

Library of Congress Cataloging-in-Publication Data
Thomson, Keith Stewart.
The common but less frequent loon and other essays / Keith Stewart Thomson ; illustrated by Linda Price Thomson.
p. cm.
Includes bibliographical references (p.) and index.
ISBN 0-300-05630-3
1. Natural history. 2. Biological diversity. 3. Scientists. 4. Evolution (Biology). I. Title.
QH81.T61115 1993
508—dc20 93-17240
CIP

A catalogue record for this book is available from the British Library.

The paper in this book meets the guidelines for permanence and durability of the Committee on Production Guidelines for Book Longevity of the Council on Library Resources.

10 9 8 7 6 5 4 3 2 1

The Common but Less Frequent Loon

Preface

It has been my great fortune that the first thirty years of my professional life coincided with the three most exciting decades for natural science in this century. I started graduate study at Harvard in the year that James Watson and Francis Crick received the Nobel Prize—at a time when the molecular revolution was under way. Quickly thereafter the field of plate tectonics blossomed, and with it geology and oceanography; both evolutionary biology and developmental biology shook off the doldrums of the previous twenty years. Paleobiology finally came into its own as a science, rather than remaining the handmaiden of comparative anatomy or sedimentary geology. Ecology linked with conservation biology and, along with population biology, went public. It has been a time of concern for the environment, starting with *Silent Spring*—alarm about acid precipitation and global climate change, loss of biodiversity and, above all, population growth. Pesticides like DDT (dichlorodiphenyl trichloroethane) were unmasked, and some birds of prey were saved thereby, even as thousands of other animal and plant species were lost to habitat degradation. It has been a period of alphabet soup, from DDT and the SST (supersonic transport), to PCBs (polychlorinated biphenols) and TCE (trichlorethylene). There have been triumphs, like the extinction of smallpox, and terrors, like the emergence of AIDS. Possibly no period has been so pivotal for natural science since the middle of the nineteenth century.

I am a biologist, or really a zoologist. In another age I would have termed myself a natural scientist or even a natural historian, except that the latter term has always unfortunately carried the understanding of amateur status. Having almost by chance chosen to study paleobiology and evolution, I have been well positioned to observe and comment on virtually the whole range of the explosion of natural science since 1960. I have focused my research, of course, as all scientists must lest we be accused of dilettantism: my field is the evolution of fishes and the origin of the first land vertebrates. But this specialization has scarcely been much of a restriction, for I have been free to write on topics as disparate as geology and DNA.

In all of this I have come to some strong personal views about the nature of science and the pleasures of being a scientist and have tried to communicate these through my writing. In 1979, Michelle Press, who was for many years the editor of the journal *American Scientist,* asked me if I would be interested in taking over the regular column "Marginalia" that had for so long been the special preserve of G. Evelyn Hutchinson, my Yale colleague. The prospect was daunting, not least because Evelyn was still a redoubtable figure on campus, whom I saw almost every day and to whom I went for advice almost as regularly. But it was also irresistible for someone who loves to write.

Nowadays science, particularly natural science, is simply part of the fabric of daily life. My essays reflect this. The chapters in this book are arranged in three groups, but they all fall together. They represent my views on the nature of science and are a celebration of the things that are important in a life fully illuminated by science—namely, books, animals, plants, people, and ideas (not necessarily in that order). The chapters are meant, dare I say, as an exhortation to my nonscientist readers to open their minds to the pleasures of science and to my scientific readers to become more literate and passionate about what they do.

I have tried to show that science is an intensely human endeavor, not some cold, abstract exercise that can succeed only if the investigator is reduced to the status of a logically acting automaton. Whether in the choice of subject or the mode of study, science is an expression of the personality of the scientist as well as his or her training, a matter of intuition as well as logic. Scientists are driven by ambition, love, fear, and greed, just as bankers and ball players are. Because science is so personal an undertaking, there is a lot of bad science and even cheating. It is also possible to be lazy—too much of what passes for science today is mere repetition of technique, a matter of applying someone else's discoveries with the blind hope that something new will turn up. There is little intellectual endeavor in secondhand work and correspondingly little spiritual reward.

Science should be much more. I believe that good science is produced only by broadly literate scientists, otherwise inspiration fails and one is doomed to ape the results of others. Scientists are also passionate, for the creative processes and the results of science are aesthetically rewarding. Scientists approach their laboratories with the same mix of joy, anticipation, and fear as an artist facing a blank canvas.

When I look at these essays, I realize that I have followed in my father's footsteps to a greater extent than I would have guessed when I set out, a

parson's son, to be a scientist. These chapters are little sermons. Some even expound upon a text. They all have morals. In another sense they are mystery stories—the unraveling and explaining of puzzles.

An essay is an *attempt.* I have attempted to write about the sort of science that I love.

Acknowledgments

Some of these chapters first appeared in a regular column—"Marginalia"—in the *American Scientist.* I would like to thank its editors, Michelle Press and Brian Hayes, for their support over the years, and I am particularly grateful to Michelle Press for inviting me to contribute to the magazine. She has always been a talented yet unobtrusive critic, as well as a friend.

In several chapters I have made slight revisions, adding citations and eliminating outdated points of reference. None of these essays would have been possible without the assistance of the wonderful library staffs at the Yale University libraries and the Academy of Natural Sciences. I am especially grateful to my imperturbable assistant, Sheryl Harris, for her help in putting this book together.

I am honored that Linda Price Thomson has contributed a series of original monotype paintings to grace and enliven these pages. Together we dedicate this book to our daughters, Jessica and Elizabeth Rose.

Contents

Part One The Uses of Diversity

1  The Uses of Diversity

This first set of essays deals with natural history—the realm of living organisms. In large part I have written about these particular animals and plants because they are dear to my heart. It is a special privilege of biologists to deal day to day with creatures and environments, processes and places—whole worlds—that are as stimulating aesthetically as they are fascinating scientifically. But one cannot be a biologist in this day and age without being acutely aware of the precarious state of our knowledge about many living organisms. Or without being aware that a race is on to learn what we can in time to stave off a crisis of unknown proportions involving the loss of many familiar, as well as unfamiliar, plants and animals from the face of the earth.

It is not just a problem for the obscure creatures of tropical rain forests half a planet away. Our spring and fall migrations of warblers, our butterflies, loons, and birds of prey—all are in decline. If they wither away, we shall lose a tremendously important part of our environment. Not all of these organisms are economically useful as food or medicine. They are part of the complex ecosystems in which we live, and they are, simply, part of us—part of our heritage—and we in turn are part of them. As they go, so do we. The future may not be as bad as present-day Cassandras foretell. But Cassandra had a habit of being right. Not doing anything seems too great a chance to take. Even the most familiar animals and plants need serious study if we are ever to be able to tackle the problem of extinction.

Not long ago my wife and I were horseback riding in the Highlands of Scotland. We passed along some fields, then entered a Forestry Commission woodland and rode down a path into a uniform stand of Douglas fir. At once it was dark, and the forest floor was bare except for a thick layer of needles and small twigs. It was cold because no sun penetrated, and completely silent. There were no birds, few insects, no shrubs or wildflowers. The stand of timber was beautiful, but it might as well have been at the lumberyard for the extra life

it supported. One species prevailed, excluding all else. That woodland may be a vision of the future world if we are not more careful.

Humans are unique in their ability to produce change in whatever they touch. The lives of other animals and of plants may be fraught with adversity and uncertainty, but they contain few naturally generated surprises. The world to which they are more or less adapted changes inexorably, and eventually they become extinct. But day to day, life to life, there is consistency, predictability. Everything about humans, however, changes all the time—from languages and tools to the environments in which we live. We constantly invent and discard things. No one now speaks Latin or Aramaic, or writes in Egyptian hieroglyphics; no one now makes those huge lines and designs in the plains of Peru; we do not fight with swords, nor do we eat mastodon meat. Normally the loss of the old and the rise of the new happen in an uneasy natural balance. In the ecosystems that we affect, and that includes essentially the whole planet, the balance has shifted. More languages, even more peoples, are lost in a decade than have emerged in a millennium. And everywhere there is the problem of biodiversity.

We are all hypocrites about biodiversity. We campaign to save whales, join societies to protect birds and wild plants, and then ruthlessly exterminate cockroaches, black flies, poison ivy, crabgrass, and ragweed, to name just a few. We contribute a few dollars each to worthy groups and collectively spend billions a year on pesticides and herbicides to control our own little environments. Then we throw up our hands at the enormity of the problem of biodiversity worldwide. Who are we to pontificate about saving the redwoods when we have explicitly and implicitly decided to let so many other species go for our own immediate convenience and gain?

All over the world, committees and commissions are studying the imperiled status of animals and plants, but they still concentrate on the bigger, more obvious species. Very few people know enough to care about the state of microscopic soil organisms or marine worms. It is easier, and no bad thing, of course, to concentrate on the lemurs of Madagascar or the birds of Hawaii. Each one may be endangered.

Is it cynical or merely realistic to stop and ask, as some folks do, What would be lost if such-and-such a species becomes extinct? The Hawaiian crow, for example, whose population has shrunk to about twenty-five, or the famous snail-darter. Will the sky now fall? The guilt is not entirely ours, either. Half of Hawaii's native birds were extinct by the time the first European settlers arrived—victims of environmental modification during settlement by the Poly-

nesians. The trouble is, it took several thousand years to lose half the birds, but the second half may be gone in a hundred or fewer.

The average member of the public, let alone a scientist, cannot easily know what the limits are: How many organisms, and of what kinds, need to become extinct before *we* need to worry? Equally, how much environmental degradation are we willing to put up with in exchange for various technological and social developments (agriculture and development, most obviously)? Reasonably, losing a few species ought not to be troublesome, and surely technology will deal with any difficulties. But how many is "a few"? How many is "too many"? Did we reach "too many" a long time ago? What risks are we running right now?

Extinction is the absolute rule in life. Death comes as inexorably to species as it does to individuals—remember the trilobites, the dinosaurs, the saber-toothed cat, and the mastodon. Current thinking is that, on average, a species may persist for only four million to five million years. Some last much longer, and many may be even more evanescent. As a general rule, rates of origination of new species from the old must keep pace with extinction. At times in the history of the earth, species diversity has crashed. We call these periods of mass extinction. At other times, origination far exceeded extinction, giving periods of mass diversification. We don't know very much about what causes these huge fluctuations in biodiversity.

A period of mass extinction started perhaps ten thousand years ago, and loss of species has accelerated beyond belief in the last hundred. Extinction rules. Indeed, although any schoolchild can name species that have recently become extinct (dodo, passenger pigeon), who can name a species that has *arisen* since 1900? Extinction and origination are totally out of balance, and we are losing species on a scale that in previous periods of earth history would have taken millions rather than thousands of years. The rate may be as high as one species somewhere in the world every few minutes. What is unusual is not extinction per se but its present very high rate and its cause—human activity.

Biologists are fond of pointing out that we know only a small fraction of the world's species, and most of the undescribed forms, especially in tropical environments, may never come to light before they are extinguished. Why should we worry? Why is less biodiversity bad? We got along fine without knowing all those other species, most of which are probably microscopic in size anyway. Meanwhile, should we stop killing cockroaches?

These and related rhetorical questions are not as easy to answer as they ought to be. But we can start by admitting that our interest in the subject is

self-centered. We don't much care whether the world will be fit for cockroaches in the year 3000. We are interested for ourselves and our children. How do we persuade people that the extinction of the Hawaiian crow matters, however? There is no single reason for preserving the diversity of living things on this planet. The main reasons why we should all be extremely worried have to do with economics, ecology, and honesty.

When we use animal and plant products as active pharmacological agents we are often drawing on the battery of defenses that those animals and plants have produced against each other and a host of bacteria and viruses. My colleague Frank Gill often points out that biological diversity is nothing less than the result of a billion or more years of natural experimentation in survival. No wonder we find it useful.

Surprisingly, however, the argument that we should stop the destruction of tropical environments because their plants and animals may include some that produce powerful new pharmacological agents (unlikely in the case of a crow unless its preen glands contain a powerful antifungal agent) is one that waxes and wanes in popularity. Of active medicines, even in the United States, fully half or more are of plant origin. There are some spectacular examples—the Madagascan rosy periwinkle that produces a potent heart drug (have all the related plants been identified, let alone tested?), the Pacific yew that produces a treatment for ovarian and breast cancer—and new medicines are being discovered all the time.

But more and more pharmaceutical companies are finding that the number of new *classes* of compound being discovered is declining—and it is new classes that they need. Variations on existing classes of compound are more easily synthesized in the laboratory than haphazardly searched for in the jungle. Twice in the past year, representatives of major companies have told me that they are concentrating their search for active compounds within the libraries of materials that they have already amassed. Other companies, however, are continuing the search in the field, often in conjunction with local shamans and herbalists, whose knowledge may otherwise soon die out. Without doubt, plenty of discoveries can be made. But the number of important compounds discovered will not automatically increase arithmetically with the discovery of new species.

The same may soon be true for the discovery of previously unknown types of crop plants. In fact, we are probably way behind in investigating the potential of the plants we have already identified. Agriculturalists are also supremely confident of their ability to breed new types from existing stocks, especially given the advances in genetic engineering. So the often repeated argument that

we need to preserve biodiversity worldwide because of the possible economic spinoffs, though still valid and important, may soon not be the driving argument it once was.

All these economic realities weaken one of the main arguments for preserving unstudied environments and, not incidentally, potentially reduce a major source of funding for research and conservation. Ironically, the greater the loss of diversity, the less reason there is to invest in what remains.

Some also argue that concentration on tropical systems and unknown organisms has deflected attention from another, vital focus: loss of biodiversity in the industrialized world. The principal reason here, as worldwide, lies in basic ecology. To say that diversity ensures strength and stability sounds like a political slogan. Instead, it is ecological good sense. The ability of any living system to cope with change and adversity is a function of its complexity. When most of the wheat or rice in a country is grown from a very few related strains, under artificial conditions using lots of fertilizer and chemical pest controls, the risk of disaster is high. We have only to think of the great potato blight of the 1800s to realize what happens when disease strikes a monoculture. When we systematically reduce diversity and particularly when we try to remove "undesirable" species from a landscape, we also remove the beneficial forms. The result of a much less complex ecosystem is concomitant instability and vulnerability.

The stand of Douglas fir that my wife and I rode through was a monoculture, in stark contrast to the woodlands that a few dedicated foresters have been re-creating in the Scottish Highlands—the native woodlands of Scots pine and birch with a diverse understory of plants that support in turn an abundant wildlife of insects and small mammals. The native forest has been quite successfully preserved (in part by keeping out the deer) at places such as Glen Affric and Abernethy Forest. The simple fact is that we must have diversity in natural and agricultural ecosystems to preserve stability. We do need to save species, thousands, even millions of them, by preserving the richness of environments. We need to be selfish, for the neck we are saving is our own.

The one great unquantifiable factor here is what drives most conservation movements: we all need something more than the basics. This view is popularly dismissed as weak, affected, or sentimental, but it is not. We need to hear the ghostly call of loons on northern lakes, to see monarch butterflies in their bright splendor on the milkweed each year. We need wildflowers in the spring. We need warblers and red-winged blackbirds—not because they are economically useful but because they meet our aesthetic and spiritual needs. Not so many generations ago our ancestors were controlled by, rather than controllers