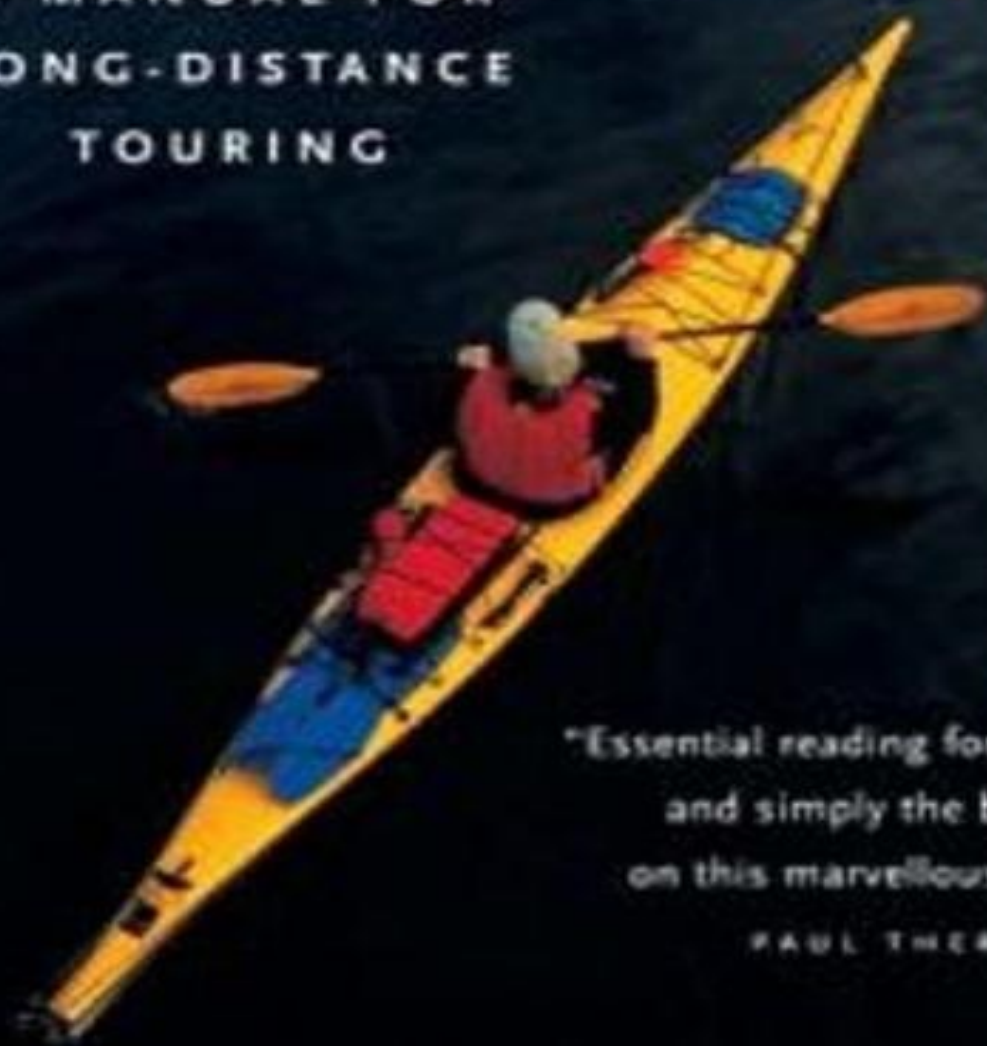


Sea Kayaking

UPDATED REVISED 5TH EDITION

A MANUAL FOR
LONG-DISTANCE
TOURING



"Essential reading for all kayakers,
and simply the best book
on this marvellous pastime."

PAUL THEROUX

John Dowd

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To Paul Souter, who provided the plans for my first kayak

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Introduction

Who would have thought, when I first dropped off the manuscript for *Sea Kayaking* at the offices of Jim Douglas and Scott McIntyre back in 1980, that there would ever be a fifth edition? The “sport” wasn’t even called sea kayaking; we picked that name for the title of the book to make it clear that we were talking about neither paddling on rivers nor using canoes. Sea Kayaking had a nice ring to it, and the name fit much better than coastal paddling, blue water kayaking, sea touring (in what?) or any number of other less precise options.

Sea kayaking has long topped the list of fastest-growing water sports. There are still more people paddling canoes and aluminum boats, but sea kayaking is where the energy is. Recently I returned to the kayak industry after some years away from it writing children’s books and home-schooling my two children. I found that much had changed during my absence. For a start, many of the small players have grown big, some gobbled up by very large fish indeed. Manufacturers such as Perception, Neck and Wilderness Systems have been bought out by multinational corporations that have seen big business opportunities in sea kayaking. The competition between these giants has been fierce. Fortunately the vitality of the small builders remains and the quality of boats is noticeably higher.

Sea kayak instruction has also become a thriving industry, but like many educational systems, has largely focussed on those aspects of the activity that can be most readily taught and measured—such as paddling skills and rescue techniques—rather than on subtler, less tangible skills such as judgement, sound seamanship and good risk management. Sea kayaking as I know it is roughly 80 per cent seamanship skills (weather assessment, navigation, knowledge of oceanography, reading of tides and currents, group assessment, coastal survival techniques, etc.) and less than 20 per cent boat handling skills (turning, going straight, rolls, rescues, etc.). The reverse is true only if all your paddling is done in sheltered waterways.

In addition, some inappropriate crossover skills have found their way into sea kayaking from racing. It has become fashionable, for example, to paddle a sea kayak as if it were a seven-kilogram racing shell, with a high, exaggerated “chicken wing” box-style stroke and racing paddles. It is a stroke that works brilliantly if you suddenly need a burst of power, but I know of no one who has paddled a loaded sea kayak for a thousand miles and maintained such a style. Yet it is being taught to skill-focussed paddlers as the stroke of choice.



British Columbia is ideal kayaking country. *Tofino Expeditions*

It has been personally gratifying to watch sea kayaking go mainstream and to know that I have contributed to this trend. Yet at the same time, I can't help but regret the loss of innocence, a time when the sight of a sea kayak on the roof of a passing car was excuse enough to pull over and chat. For paddlers, it has been a period of much learning and relearning, and the threads of knowledge and communicable experience have formed a rich tapestry. Books on the subject have proliferated—and improved.

Early editions of *Sea Kayaking* to date have sold nearly 60,000 copies, but this is hardly an adequate measure of existing interest in kayak touring. Whereas the only books available on the subject at the time of the first edition were Adney and Chappelle's *Bark Canoes and Skin Boats in North America* and a few British "canoeing" manuals that drew heavily on river experience, today dozens of manuals and trip narratives line up on kayak shop shelves. There are instructional videos and numerous guides telling you where to paddle or how to camp, forage and cook when you get there together with the definitive work on kayak navigation by David Burch, *Fundamentals of Kayak Navigation*, and the eminently readable *Sea Kayak Navigation Simplified*, by Lee Moyer. There are now several specialty magazines, and articles on kayak travel adventures are no longer rare in the mainstream press. The sea kayak has been adopted by the advertising industry as the ultimate "freedom" accessory.

Much has been printed on the history of kayaking, thanks to the research of the late John Heath, David Zimmerly, George Dyson and Eugene Arima in North America, H.C. Petersen in Greenland and John Brand in England. It is clear from their research that the best traditional Native kayaks were extremely sophisticated, well-designed craft from which our modern-day builders have learned a great deal yet stand to learn much more. Once again in this edition I have resisted the temptation to dabble in the world of kayak history, which I consider to be beyond the scope of this book. We are heirs to a long and complex tradition, one without surviving masters—just students, evidence and memories.

There is now, as there was long ago, a kayak for almost every purpose—from the slender West Greenland-style boats, originally designed for hunting among ice floes, to the 6.5-metre (21-foot) touring double or triple that cruised the Pacific coast. Each has its own merits and limitations, and each its band of dedicated advocates. My personal preference for a touring single is a roomy, relatively stable craft about 60 centimetres (24 inches) in the beam. Although I would pick this for solo coastal cruising, it might not be my first choice for day paddling off Hawaii, and I would want yet another craft for cruising with young children. It is this very diversity of boat design that makes sea kayaking so overwhelming for the first-time paddler looking to choose the right boat, and it is one of the objectives of this book to help clarify the kinds of choices that should be made.



Indonesia. *John Dowd*

I have based this book mostly on my own experience, but occasionally it has been necessary for me to write beyond what I know firsthand to present a more balanced picture of sea kayaking when covering such topics as obscure methods of rolling and kayaking in sea ice. I have gratefully called upon the expertise of others, among them the late John Heath, whose knowledge of traditional kayaking techniques was first highlighted in Adney and Chappelle's aforementioned classic.

Because the knowledge required for sea kayaking is so encompassing, I have also frequently chosen to omit the general in favour of the specific. For example, my chapter on first aid ignores such essentials as cardiopulmonary resuscitation (CPR) and the treatment of bleeding, since these are well covered in general publications on the subject. It focusses instead on kayak-related ailments. I trust the reader to know the basics already—for know them he or she must when embarking on a sea journey.

Navigation, camping and general survival are other areas in which I have assumed that the reader is not a novice. The information presented here is geared to kayaking situations and seen from the viewpoint of a kayaker, focussing particularly on those problems most likely to be encountered on

long kayak journeys. If you need specialized survival information, books such as the *SAS Survival Handbook* do the subject justice.

I have attempted to make this fifth edition useful for paddlers of all levels, though with an emphasis on the more ambitious paddler. For blow-by-blow basics, I recommend Shelley Johnson's *Complete Sea Kayaker's Handbook*, which covers in detail much that I take for granted. The need for useful answers to kayaking problems usually calls for illustrations that provide lessons valuable both the beginner and the experienced paddler. In most instances I have elected to present advanced examples in preference to basic ones, in the belief that beginners' lessons are contained within an advanced situation but not vice versa. This is not to imply that paddling storms or wild lee shores or undertaking 20-mile crossings is the norm; it is not. Indeed, I counsel strongly in favour of a measured approach to new kayaking experience. It is my hope that this book will provide a vision of what is possible to those who bring an adventurous spirit to their kayaking.

Note: Miles in this book are nautical miles unless otherwise stated.



Laguna San Rafael, Chile. *John Dowd*

THE BOAT

Sea kayaks are distinguished from river kayaks by a multitude of features for which we have one word: *seaworthiness*. A sea boat may or may not roll easily, but it must slice through or ride over waves of all sizes, track dependably regardless of the direction of the sea, respond to the paddle in windy conditions, carry your gear and stand up to continuous punishment from wave action, weather, sand, rocky beaches, sea ice and sometimes very large, very inquisitive fish.

Nevertheless, there are many types of boat to choose from, and every dedicated kayaker is his or her own best authority on “the best kayak.” You have to choose the right one for your use. There are dozens of manufacturers as well as numerous designs for home-built kayaks in modern or traditional styles.

Most sea kayaks have a sharp prow and an angular or even knifelike forefoot. Amidships, the hull is either chined or rounded, with some flattening in cross section. Farther aft, the cross section resumes its rounded V shape, and the stern itself may be as sharp as the prow. As a rule, sea kayakers have moderate rocker (the curvature upward of the keel-line towards stem and stern as the boat is viewed in profile). This enhances the manoeuvrability of the craft. A deep, sharp stern allows the boat to track through the waves without yawing under the alternating thrust of the paddle. The rounded section amidships allows the boat to lean smoothly into breakers or helps carve a turn, and the partial flattening under the cockpit increases stability. A high prow is found in some designs, including many of the surviving or recorded Inuit and Aleut boats. Such a bow adds buoyancy forward and may help reduce weathercocking in some designs. It can be a useful feature in ice but is of questionable value in open water and today is probably included more for appearance than for function. As already indicated, in some hulls you will see chines. These are ridges, angular in cross section, running lengthwise along the hull between gunwale and keel. In fabric or skin-covered boats they are caused by the tension of the skin across a framing rib; a similar feature is sometimes moulded into fibreglass boats such as models where the chine aids turning or provides a shoulder of stability when the boat is leaned to one side.



Drawing heavily on sailboat design, Matt Kirk-Buss has come

up with some refreshing and successful turns of design in

his Loki sea kayaks. lokikayak.com

Slalom kayaks, designed for quick turns in rivers rather than tracking at sea, have much more rocker than a sea boat, and their hulls are generally flatter in cross section amidships and considerably rounder at bow and stern. They are also shorter. A river boat is often used for surf kayaking and when fitted with a skeg or rudder will sometimes serve for a short sea voyage, but the compromise is not finally a happy one. Away from white water, it is better to have a kayak true to the ancestry of the craft: a boat designed specifically for the sea.

Narrow touring kayaks

Narrow touring kayaks are usually single-seaters between 5 and 6 metres (17 and 19 feet) long with a 46- to 58-centimetre (18- to 23-inch) beam. They commonly have a rounded hull, hard chine and moderate V hull with varying amounts of rocker. Essentially they are coastal craft, and a paddler using them in wind or open water should be comfortable with the technique of rolling. These boats depend on the skill of the paddler for their seaworthiness. They are, in essence, tippy. (Tippiness, however, is a relative term. How tippy a boat is depends on the paddler's familiarity with that type of kayak as well as on the paddler's weight distribution: a broad-shouldered man will have many more problems with balance than a lightweight woman with solid legs and hips, since most of the woman's weight will be close to the centre of gravity.)

The West Greenland and Aleut kayaks were made from sealskin with a fragile wood and bone frame, but today the most common boats in this style are plastic, fibreglass or Kevlar. Although these 50- to 56-centimetre (20- to 22-inch) beam kayaks have been used on some impressive coastal trips, most notably the circumnavigations of New Zealand, Britain, Australia and Japan by Paul Caffyn and the circumnavigation of the Hawaiian Islands by Greg Blanchette, they are usually best suited for day tripping and lightweight excursions because of their small volume and rather wet ride.

The great advantages of narrow touring kayaks are the ease with which they can be rolled and the speedier hulls. The most obvious disadvantage besides their limited stowage space, which makes them less suitable for journeys on which food and equipment must be carried in quantity, is the fact that they are neither stable enough nor roomy enough to provide real relaxation, or even to serve as a platform for photography. They are deadly if their occupant becomes exhausted or incapacitated at sea in severe conditions, unless rafting up is an option or external flotation is added.



Chris Duff, paddling the Romany touring kayak he chose for his trips around Ireland, Iceland and the



Paul Caffyn in his modified Nordkapp. Paul is in a paddling class of his own with trips around New Zealand, Australia, Japan and Great Britain as well as large sections of the coasts of North America and Greenland to his credit. *Courtesy of Paul Caffyn*

At the fringe of what can be considered a sea kayak—and not part of the focus of this book—the various specialty boats used exclusively for ocean racing, surfing or just mucking about casually. Most distinctive among these is the surf ski, a long (6.5 metres, or 21 feet), narrow (48 centimetres, 19 inches) kayak designed for sitting on rather than in. A foot-controlled rudder assists the paddler in following seas and cross winds, while a quick-release belt keeps the paddler in place during turbulence. Not surprisingly, surf skis are mostly used in the warm waters of Australia, South Africa and Hawaii. The most famous race for this class of kayak is the annual escorted downwind dash across the channel from Hawaii's Molokai Island to Oahu Island, with an average speed that sometimes exceeds 8 knots. In the Pacific Northwest and the Great Lakes, a new breed of sit-in ocean-racing kayak has evolved to give an edge to competitors. This craft is best described as a cross between a downriver racing boat and a sea kayak.

Another wrinkle to kayak design for the sport of surfing has been the evolution of the wave ski. To call this planing, hulled, sit-on board a kayak is stretching the definition of the word, but some manufacturers show bikini-clad women paddling them with a beer cooler secured to the stern! In the element on the face of a 3-metre (10-foot) Hawaiian breaker, however, these stubby little craft are clearly the end product of a very specialized line of evolution, and they make surfing in a touring kayak look like trying to ride a log to shore.

General touring kayaks

The general touring single-seaters are much more prevalent than their narrow counterparts. They are generally shorter—between approximately 4 and 5 metres (14 and 17 feet)—and feature a beam of about 58 to 69 centimetres (23 to 27 inches), yet some have a grand 80-centimetre (32-inch) beam and are so stable you can stand up in them. The greater stability of general touring boats enables you to rest and relax in them, though in extreme cases it tends to discourage the learning of more advanced paddling skills. These boats generally have a greater load-carrying capacity than the narrow singles and give a much drier ride. But because they are designed to be paddled loaded, their higher profile can make them vulnerable to wind when empty.

The beamier singles are usually not as fast, maybe a half-knot slower than their skinnier brethren and are more difficult to roll, but then they are far less likely to require rolling.

Having clearly defined two types of singles, narrow and general touring, I will now muddle the distinction by pointing out that there are a number of crossover models that could almost be placed in either category.

Crossover kayaks

The immediate ancestor of the hardshell cruising kayak, single or double, is the collapsible kayak or foldboat—a design pioneered by the German tailor Hans Klepper around the turn of the century and itself based on original boats from the Canadian Arctic. The German models were originally manufactured for lakes and rivers. They have long since lost their pre-eminence in the field to hardshell kayaks of fibreglass and polyethylene, but because some of these collapsibles are suitable for use on the open sea and are convenient for travellers, they have continued to be popular in Europe and North America.

Unlike the Native peoples of Northern Canada and Greenland, who used single-seat kayaks for inshore hunting, the Aleuts of Alaska designed two-seat models for longer, more exposed voyages. These boats were given a third cockpit at the instigation of Russian fur traders and named *baidarka*. They were used for hunting and trading voyages east of the Aleutians and as far south as Baja California. Today the closest approximations to the larger Aleut craft are the *baidarkas* built by George Dyson of Bellingham, author of the book *Baidarka* and founder of the Baidarka Historical Society. Using modern materials—chiefly nylon cloth and aluminum tubing—Dyson has built several kayaks with many of the original *baidarka* features. His triple-seater is 8.5 metres (28 feet) long with a 76-centimetre (30-inch) beam. It is very stable and can carry a sail. Dyson's experimental fan sail design is most original: ashore the sail can double as a tent. Like its predecessors, this *baidarka* can carry some 270 kilograms (600 pounds) of equipment. Apart from the materials used, its greatest departure from traditional design is a sturdy foot-controlled rudder.



A Feathercraft folding kayak. *Joel Rogers*



The *baidarka* is one of the principal models that defined today's modern kayaks. This replica, built by Ben Fast, is the famous Unalaska design. It was originally built as a single and was converted to a double. *John George*

Recreational kayaks

During recent years a third significant class of kayak has evolved. These generally short, stable little craft are often referred to as recreational kayaks (or rec-boats). Their two outstanding virtues are

their price and their small size, which makes them ideal for carrying aboard sailboats as tenders and for mucking about off calm beaches and on ponds and lakes at the cottage. At this writing, they have one major flaw, however, and it is one which I suspect will return to haunt the manufacturers in the future: the absence of adequate built-in buoyancy. For that reason by no means should they be considered for the sort of trips that are the subject of this book. That said, they are frequently fine functional kayaks within the limits for which they were designed.

CHOOSING A KAYAK

Choosing the right kayak is like buying any other large-ticket item: the world suddenly becomes full of instant experts eager to give you advice and warn you of the pitfalls of this or that feature. Buying on the secondhand market is, of course, usually cheaper but fraught with dangers unless you know precisely what you are looking for. If you seek the advice of friends, you will usually buy the same boat as they have because they have grown to love theirs and can sing its praises loud and clear; they also have an investment in reassuring themselves—and you—that they made the right choice in the first place.

By doing the round of designers, you will quickly realize that the so-called experts can disagree spectacularly on such fundamental features as the shape of the bow. I once heard a designer (redesigner might be a more appropriate term, since most design today is simply a modification of an existing design) being asked why he had put a long upswept bow on his kayak. He explained that it was to stop the boat from pearling (nose-diving in following seas). The customer thought about that for a while and then asked why the other boat he had built had a low bow. That too was to stop pearling, the designer explained a little sheepishly. Certainly there are few clearly right or wrong features—mostly trade-offs and preferences.

Probably the best way to choose a kayak is to visit a sea kayak symposium, one of the major sea kayaking clubs or a specialty store offering a wide range of models. At the store, seek the general guidance of a sales clerk but don't listen too closely to anything the person tells you about how a boat handles—just take it out and try it. The problem with this approach, however, is that most beginners prefer a very stable kayak for a start; later, as they become more skilled, the stable boat could feel dull. So rent some kayaks with an eye to purchasing. You may still choose the stable boat in the end, but it won't be because you are afraid of the others.

Before you can expect to make sense of the hundreds of models of kayaks now available on the North American market, indulge in a little fantasy. Cast your mind back to the genesis of your interest in sea kayaking, that dream of how you see yourself in a kayak. Maybe it is a weekend tryst to the fire-secluded cove you and your partner come across; or maybe it is a King Farouk-sized challenge in nature with just you and your little boat duelling the ocean creamers; or maybe you wish to use the kayak for wildlife photography or an evening workout. Got the image? Well, hold on to it, because now you have to use that image to find the right boat.

Unfortunately, there are at least two other factors that will complicate your choice: your budget constraints and your partner's or partners' sizing needs. Today there are singles, doubles, folding boats and rigid ones built of fibreglass, Kevlar, plastic, canvas/lath and nylon/aluminum tubing, plywood and cedar strip. There are both cheap and expensive kayaks, but it is the variety and quality of the new boats that sets them apart from those of ten or twenty years ago.

Singles

The most popular sea kayaks are rigid singles—the freedom boats for those who seek independence or who are obliged through circumstance to paddle solo. Rigid singles are also the group with the most diverse designs, so the chance of finding the perfect boat for you is greatest in this category. Couples, however, should keep in mind that two singles will likely cost considerably more than a two-seater.

Doubles

A double is particularly appropriate if you and your partner are of significantly different strengths or if the trip you plan is extremely arduous or if you are going to a remote area. After all, you cannot easily become separated from a companion in the same kayak, and two paddlers in a double are certainly a stronger unit than the same two paddlers in singles. Few doubles can be successfully paddled by one person under difficult conditions, however, with the exception of the downwind ocean crossings in which Hannes Lindemann and Ed Gillet chose doubles (see Appendix A).

High volume or low volume?

A high-volume single kayak is one with a volume of around 500 L (18 cubic feet), while a low-volume one runs about 285 to 340 L (from 10 to 12 cubic feet); there can be appreciable volume differences between two-seaters as well, but not to the same extent. Choosing the right-sized kayak is not quite as straightforward as choosing a pair of shoes, since most people select a kayak for the load it carries as well as for its fit. Others have a clear and unshakeable, preconceived idea of what a kayak should feel like, and they know exactly when they feel it. But choosing a kayak as you would a shoe is a pretty good place to start, since generally if you are a small person (under 68 kilograms, or 150 pounds), you will prefer a small boat, and if you are a larger person (say, over 80 kilograms, or 180 pounds), you are going to feel more comfortable in a larger boat. If you had no special load-carrying considerations, you would buy roughly according to such sizing.

For people who are 5 foot 2 inches and sport a pair of size 14 feet, the rule of thumb breaks down. You need a bigger boat to accommodate your tootsies. Even if you have no unusual physical attributes, you may choose a higher-volume boat so that you can carry plenty of fresh food along on your trip, or a few bottles of Chablis, or a box of camera equipment. People who fish for salmon from their kayaks should consider what they would do if they hooked into a 30-pounder. (They will be glad of the extra stability that usually comes with a higher-volume kayak and may judge the trade-off a good one.) Those who feel stiff-jointed and awkward getting into a kayak may also be glad of a little extra clearance in the cockpit and deck area.

Conversely, there are 190-pounders who get a great kick out of paddling fast in a sporty kayak, eating freeze-dried food and having waves wash over them every few seconds. They have absolute no interest in taking pictures from a kayak unless they show crooked horizons intersecting the uplifting profile of their kayak midframe. For these people, too, the rules of high- and low-volume choices are accommodately elastic. If, however, you find that you are obliged to pile gear on deck because your boat's interior will not accommodate your needs, or if you find that you are viewing the waves from the wrong side more often than you should, try a higher-volume boat with a more stable

hull.

Rigid or folding?

Put simply, you should choose a rigid kayak unless you need one that folds. Or you may prefer the aesthetics of a boat with the traditional internal frame—a boat that performs as silently as the original hunting craft and flexes in the waves like a living thing.

The advantages offered by rigid kayaks are numerous: for a start, there are more of them, so the chances of finding the right boat for your needs is going to be greater; they require less maintenance, less care around rocks and less concern about the effects of the elements; they are also usually much cheaper. They also have more room for gear, since there are no frames to get in the way.

The reasons for buying a folding kayak, however, are often as compelling: you may need to break down the boat for travel or to store it in an apartment. Such craft literally promise you the world of kayak touring in a backpack—Japan, New Zealand, the Aegean, the Caribbean . . . The price for this versatility is not just measured in dollars; you must nurse your folding kayak over coral or barnacle-encrusted intertidal zones and wipe the sand off your feet and bags before placing them inside, since grit beneath the stringers will chafe the hull, rub away at the varnish or jam up the joints of an aluminum frame. Folding kayaks are simply fussier to own and maintain, something to think about when you reach for your chequebook. Assembly time for most folding kayaks is a fairly modest fifteen to thirty minutes once the learning curve has levelled out.

Those who require more compactness than they would get from a collapsible kayak might consider the purchase of an inflatable kayak. (Audrey Sutherland of Hawaii has forced sea kayakers to take these stubby little craft seriously by paddling more than 12,000 nautical miles of British Columbia and Alaska coasts, Norway and Hawaii in one during the past twenty years.) Apart from being lightweight, inflatable kayaks are the least expensive of folding craft.



Audrey Sutherland, paddler extraordinaire, in her inflatable kayak. *Courtesy of Audrey Sutherland*

For those who strongly prefer rigid kayaks yet need to reduce their overall length for storage, several manufacturers produce take-apart rigid boats. These boats, however, tend to be heavy and expensive—since, to minimize weight, they must be made of Kevlar—and prone to difficulties when they join.

Materials

Fibreglass kayaks are usually a combination of cloth, roving and, in some of the more cheaply constructed models, chopped matte. Matte provides stiffness and, when it is thick enough, strength but results in a heavy and somewhat brittle hull. Most builders now use foam core or an internal keel of either foam or spruce to gain the hull rigidity required for strongly secured bulkheads and optimum kayak performance. The really high-tech boats are built with an initial layer of fibreglass cloth to improve abrasion resistance, followed by layers of Kevlar well stiffened with carbon fibre. Such boats are lighter, stronger and more expensive than their equivalent fibreglass models. Standard weight for a fibreglass kayak is around 25 kilograms (55 pounds) for a single and 40 kilograms (90 pounds) for a double.

The resin preferred by most fibreglass kayak builders today is vinylester, which is more flexible than the cheaper polyester resins and not as toxic as the tough epoxy resins. Most fibreglass kayakers are protected with a hard abrasion-resistant layer of gelcoat. This is the first layer to be sprayed into the mould and carries the pigment, which helps protect the resin and fibres from the damaging ultraviolet rays of the sun. Most kayakers come with a white hull, since white shows the scratches less than a dark colour. White does not, however, stand out well when the kayak is upside down amid breaking waves. The choice of colour for the deck depends on whether you want to stand out or blend in with your environment. The best colour for visibility is yellow, and the most visible boat is one that is yellow top and bottom.

The rotomoulded polyethylene kayakers are stronger and more economical than fibreglass models though not so abrasion resistant. (They should not be dragged, since effective repair is problematic.) Two principal types of material are used: linear polyethylene and its tougher, stiffer and more costly cousin, superlinear polyethylene.

The disadvantages of these polymer kayakers are that they are heavier (by about 4.5 kilograms, or 10 pounds) than most fibreglass models, and they scratch more severely than gelcoated fibreglass. They seem particularly vulnerable to denting on roof racks in the hot sun, but dimples can usually be popped out with a stick wedged inside the boat or with the selective application of boiling water. The life span of polymer kayakers, UV inhibitors notwithstanding, is usually less than that of fibreglass kayakers, though the life span is going to vary greatly depending on the care taken when you store the boat. When they are kept outdoors, these boats should be wrapped in a protective tarp to minimize UV damage.

Rotomoulded kayakers are made in an expensive nickel, steel or aluminum mould that is heated usually in a gas oven, and then opened to receive a measured amount of plastic granules. This is where science ends and art begins; the mould is then rotated slowly and rocked end for end in such a manner that the melted plastic runs to an even thickness over the inside of the mould as it cools. As the newly formed boat cools, it contracts and must be handled carefully until it has set in its final form. Blow moulding, an even more costly process used by Prijon, uses a denser plastic that results in a stiffer boat that will last longer and may be welded.

Polycarbonate kayakers are now on the market thanks to the experimental work of Eddyline. They are made from polycarbonate sheets that are heated into a mould, sometimes combined with layers of fibreglass or Kevlar. These boats tend to be priced somewhere between fibreglass and polyethylene and weigh a little less. They are less expensive and stiffer than boats of regular composite construction, though there are some size and form limitations due to the nature of the polycarbonate sheets.

Wood kayaks are a fast-growing part of the sea kayak market. Most are of the home-built variety, either constructed from a kit using sheets of marine-grade plywood stitched and then glued together or from thin cedar strips laid over a form and sheathed in fibreglass and epoxy. These kayaks are frequently of great beauty and often are surprisingly durable, given the right amount of maintenance. They are fun and inexpensive to build, the most common reason for choosing this type of boat over its less easily damaged fibreglass and polyethylene relatives.

Also popular among home builders are lath and canvas models and replica traditional kayaks which can be built from plans and locally available materials. Such boats have an internal frame of wood with ballistic nylon or 14-ounce canvas stretched over it and then painted or varnished. The life of the fabric is from five to ten years, after which the boat can be stripped to its skeleton, the wood revarnished and a new skin fitted. These kayaks are lightweight, inexpensive and easy to build, though not exactly bombproof. A tougher hull can be created with the use of high-tenacity nylon or rubberized cloth.

As we have seen, standard folding kayaks consist of a frame and removable skin. Frames are commonly made of wood or aluminum or a combination of both in boats made by Folbot. Ash is the most common wood for longitudinal frame pieces because it is both durable and flexible. Cross-frames of birch plywood are used in Kleppers and Nautiraid kayaks. Feathercraft boats feature a frame of high-grade aluminum with a baked epoxy coating and cross ribs of high-density polyethylene. New Zealand company, First Light, has started production of a tubular carbon fibre folding kayak that weighs in at only 9 kilograms (20 pounds).

Wood has the advantage of being relatively easy to repair, though of course there is nothing to prevent you from using wood for temporary repairs to an aluminum or carbon fibre frame in the field. The disadvantage of wood is that it can absorb water and swell. Aluminum, in contrast, suffers from its vulnerability to corrosion and electrolysis—particularly in warmer climates. All folding boats should be disassembled regularly to prevent them from metamorphosing into rigid ones. Small metal assembly parts are present on most frames and will need special care.

Today's hulls are made from Hypalon, nylon-covered butyl rubber, or specially formulated urethane or a less expensive vinyl composite. Feathercraft is now using Duratek, a ballistic high-tenacity nylon, instead of Hypalon.

Deck fabrics vary widely. Cotton is still used, and though it is somewhat vulnerable to damage by ultraviolet radiation, it breathes, allowing air and moisture to pass through. This characteristic keeps the boat pleasantly cool in the tropics, since evaporation occurs off the inside, providing a natural air conditioning system. Feathercraft is now using Poly-Tech, a polyurethane-coated nylon that can be radio-frequency welded to ensure waterproofness. This material is lighter than cotton, particularly when wet. It is also waterproof, rot resistant and shrinkproof.

Hull design

Hull shapes and their significance, I confess, are aspects of boat building that mostly elude my understanding. Why is it that one successful model is fish form (its widest beam forward of the cockpit) while another is Swede form (its widest beam aft of the cockpit) and yet another is symmetrical? What are the key features that make them work? Does it really matter? My basic ignorance is not for want of trying to understand. I listen, along with the other kayak users, to the explanations of designers, and I marvel at their plausible reasons for why the hull was rounded just so

why this or that amount of flare was put in the bow to give added lift at speed and, of course, how they went about ensuring that their boat would not pearl as it surfed off the wave. I marvel at the science building supposedly turbulence-triggering diamond-shaped ridges into the hull so as to disrupt laminar flow and prevent drag! I often find such talk disconcerting because I happen to know that the designer simply took a design, padded it out with bondo paste, added a foot of length amidships, changed the shape of the stern, adjusted the pitch of the deck, added multiple chines for stiffness, tried it out to see if it had improved any, then attempted to rationalize the results.

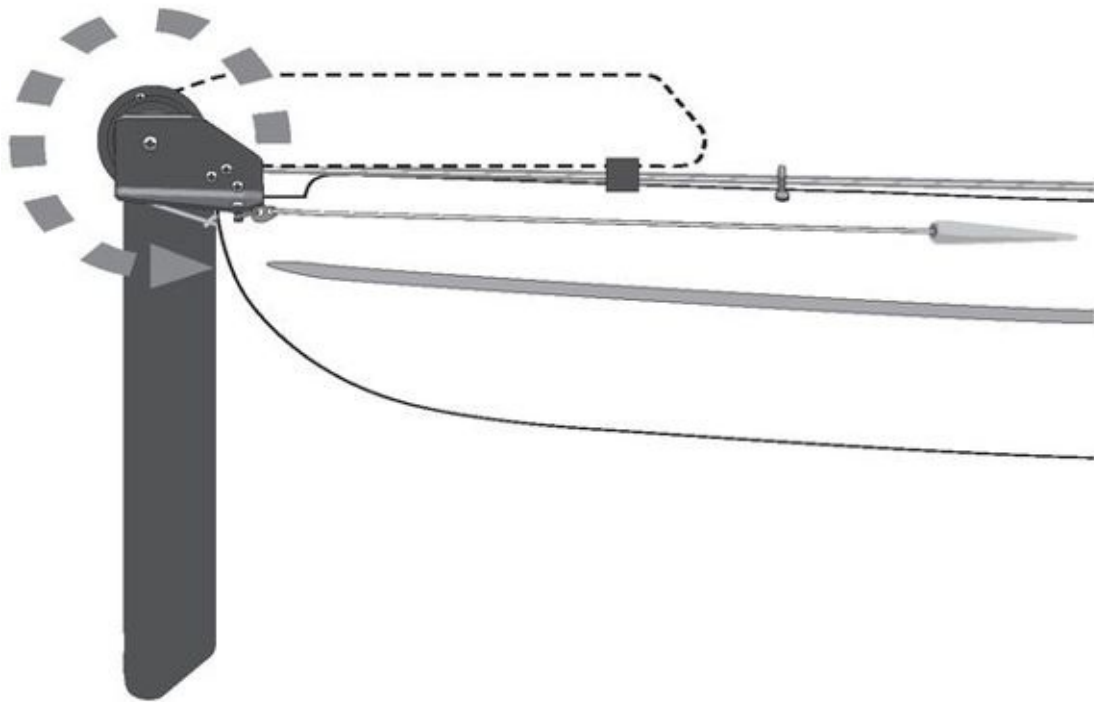
To learn something objective about hull design and answer some of the more basic questions, *Sea Kayaker* magazine once sponsored a series of tests on popular models of touring singles within a given length and beam range. During the first testing of eleven kayaks, engineer and kayaker John Dawson supervised the program using the magazine's own facilities and the \$2000-a-day test tank at the B.C. Research laboratories in Vancouver. Various tests demonstrated that some boats behave differently from others and revealed some startling facts—for example, that raising the height of the seat by 2 centimetres (1 inch) could halve some kayaks' stability. The tests also demonstrated, however, that some boats that looked radically different behaved almost identically. Almost nothing could be confirmed about basic hull design except for the most obvious stuff—such as that long, narrow boats go slightly faster than short, fat ones—and even these differences were not nearly as great as had been expected.

Computers have not yet provided us with the answer, either, since they consider only the wetted surface on calm water and not the effect of construction above the waterline, such as the profile of the deck. Too often when designers have relied on the computer for their inspiration, a dog was born—garbage in, garbage out and all that. We seem to be so far from understanding why one hull works and another does not that I doubt I will see the day when we can accurately project our knowledge to design radical new shapes (or perhaps radically ancient shapes) for boats. Today kayak design still lies mostly in the realm of craft and living tradition, and perhaps it is better that way; at least it allows for some imaginative explanations. I also draw some comfort from the embarrassment that must have been felt by the designer of *Magic*, a 1983 challenger to the America's Cup, which, test-tank researcher Francis Clauser discovered, travelled through the water more efficiently backwards than it did forwards, rudder in place and all. So much for science and boat design.

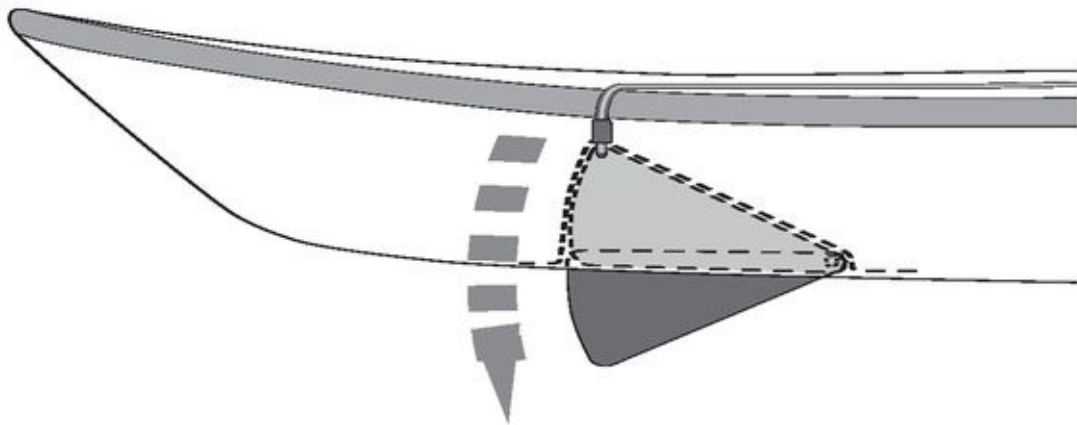
Having made my reservations abundantly clear, let me repeat some of the popular wisdom that has gained credibility: long kayaks (up to about 7 metres, or 23 feet) are faster than short ones, given a powerful paddler (if the paddler is not strong, a long boat may actually be slower because of the greater wetted surface); wide kayaks are more stable and more difficult to lean than narrow ones; round-bottomed boats can be leaned more smoothly than flat-bottomed ones. (Despite optimistic rumours to the contrary, narrow boats have not proven themselves to be more seaworthy than wide ones.) Fish-form hulls are said to be more efficient than Swede-form ones by half the builders, while the other half swear it is just the opposite. A deep forefoot makes a boat hard to handle in wind, as does a high bow. A faintly V-shaped hull provides stiffness and aids with tracking when the V is carried aft of the cockpit. Rocker helps with turning; the more rocker, the more easily the boat turns but the harder it is to hold on a straight course. A fine entry cuts the waves cleanly but requires above-the-waterline buoyancy to prevent plunging. The stern should have both volume for buoyancy and a fine exit to minimize friction from turbulence.

RUDDERS AND SKEGS

A rudder, operated by cables running forward to controls at the paddler's feet, saves effort on an open sea kayak. It is a necessity on the larger doubles if they are to hold course in cross winds or be turned efficiently. A good rudder allows you to devote your paddle strokes to straightforward propulsion with an occasional support stroke. For years I paddled a single with no rudder, and I can remember times when, in order to stay on course in a cross wind, I paddled fourteen strokes to port for every one to starboard. A rudder alleviates this problem. In singles, however, a rudder should not be considered a turning device to replace the ability to manoeuvre with the paddle or to control major broaching problems. It saves effort in maintaining a course in cross winds, and though some additional drag results, the compromise is usually a good one.



A flip-up, manually retractable rudder.



A retractable skeg, controlled from the cockpit.

Kayakers who are proud of their repertoire of paddle strokes are sometimes put off by rudders, as if it were demeaning to guide the kayak with the feet, and the problem of insecure footrests can be a serious one for some people when rolling. But on a long voyage, or even a short one during adverse conditions, this device can save much wear and tear on belly and shoulder muscles. A well-designed rudder, usually of high-grade aluminum or stainless steel, can always be cocked out of the water where it will be less likely to become damaged and will not impede the ability of the kayak to be turned sharply while being leaned onto its gunwale. The best situation is to have a sea kayak that paddles well without a rudder but that has one anyway.

In doubles, rudder controls can be in either the forward (No. 1) or aft (No. 2) cockpit. The paddler

in the No. 1 cockpit has an unobstructed view of the bow and what lies immediately ahead, where the person in the No. 2 position has a more commanding view of the whole boat and a greater sense of control. It is useful to fit auxiliary stirrups to the rudder cables so that they can be operated from either cockpit.

A rudder takes quite a hammering on a long trip and must be strongly built. It should be cocked for negotiating surf or for lying to a drogue and should kick up automatically on striking a submerged rock. In surf, rudders can be downright dangerous to anyone in the water or to anyone attempting to scramble aboard over the afterdeck.

I have to eat most of the disparaging comments I made about skegs in the earliest editions of this book. Since then, I have paddled kayaks with skegs that worked well, and though I have yet to prefer them over a good rudder, I am impressed. The skeg amounts to a fixed rudder, which is occasionally adjustable and is usually designed to be lifted out of the water. It shifts the pivot point aft in smooth water on round-hulled craft such as whitewater boats, and it enhances the tracking ability of most manoeuvrable yet V'd touring kayak hulls. The ideal placement for the skeg appears to be just aft of the seat, located in a boxed slot recessed into the keel-line of the boat. The blade is raised and lowered with a cord leading back to the cockpit; thus, the amount of draught can be adjusted according to conditions. A skeg or a retractable dagger board so placed is almost never lifted clear of the water by passing waves, enhancing its effectiveness in rough seas. In addition, placing the new pivot point closer to the natural (central) pivot point makes the boat much more manageable in wind than it would be if the skeg were placed at the stern.

BUILT-IN BUOYANCY

Without special buoyancy systems, fibreglass boats will sink as soon as they fill with water. Polymer kayaks will float so low as to be unmanageable. The best buoyancy is usually the most built-in buoyancy, and every opportunity should be made to maximize and back up buoyancy systems. The most effective one is a boat full of foam or air in sealed compartments. A number of other provisions for built-in buoyancy—including the air sponsons of some folding kayaks, the blocks of foam that some people permanently jam into bow and stern, and the watertight bulkheads, pods and self-draining cockpits found in various models of rigid kayaks—are more practical because they leave room for gear and legs. The benefits of built-in buoyancy become especially obvious when one considers the number of inexperienced paddlers borrowing or buying used kayaks from individuals who may neglect to explain or emphasize the need for adequate buoyancy. Over the past few years, the rash of fatal and near-fatal accidents involving insufficiently buoyant boats that sank or could not be re-entered have made this message even clearer. The disadvantages of built-in buoyancy are that it can wear, fail or prove insufficient—and this is why it should not be relied on without backup systems of waterproof air-filled gear bags.

Bulkheads and hatches

Watertight bulkheads made from either fibreglass or closed-cell foam caulked into position provide dry stowage and structural support as well as buoyancy. To be effective, bulkheads should be fitted as close to the back of the seat and as close to the end of the footrests as possible; this placement will

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