The bear necessities

The fortunes of the bear populations of British Columbia's Great Bear Rainforest are intimately connected with those of the salmon on which they feed. But according to recent research, that connection goes all the way to the forest itself. **Nick Garbutt** reports

PHOTOGRAPHS *by* NICK GARBUTT

The fetid aroma hit me first: a pungent cocktail of salty sea, heady pine and rancid decay, twisting like a bottle-brush inside my nose. It certainly wasn't what I expected to experience in the ancient coniferous woodland on Gribbell Island, part of the remote wild coast of British Columbia known as the Great Bear Rainforest.

As I picked my way over roots and fallen logs festooned with deep cushions of damp moss, I saw the corpses of salmon – some virtually whole, others decapitated and shredded – strewn around the forest floor, a macabre scene that resembled the aftermath of a Biblical flood.

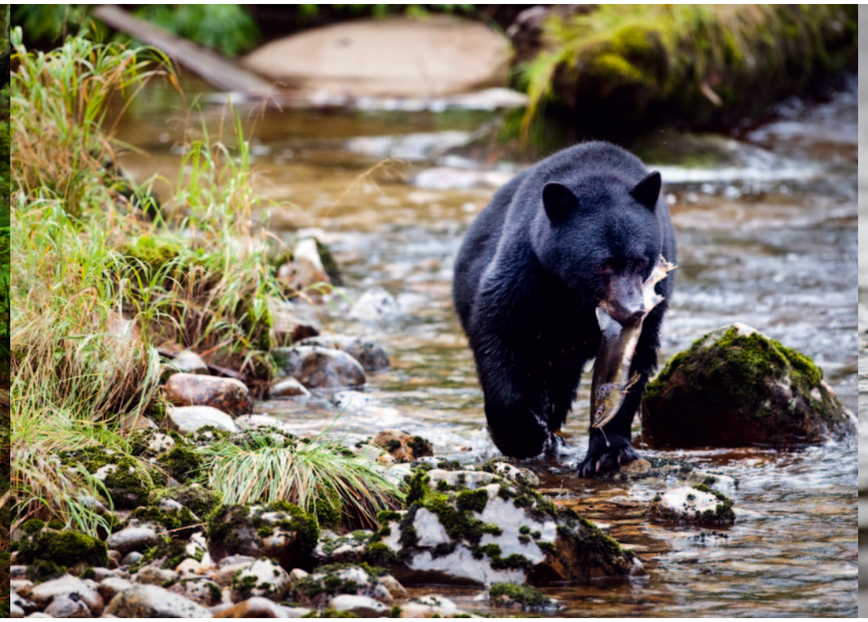
As I neared a stream, the number of bodies increased and the stench intensified. The stream was barely five metres wide, its shallow, crystalline waters bubbling and boiling around boulders, then easing into deeper glides. As I loomed over a dark pool, the apparently empty waters erupted as countless salmon scattered in a frenzy, bursting through the surface and bolting upstream.

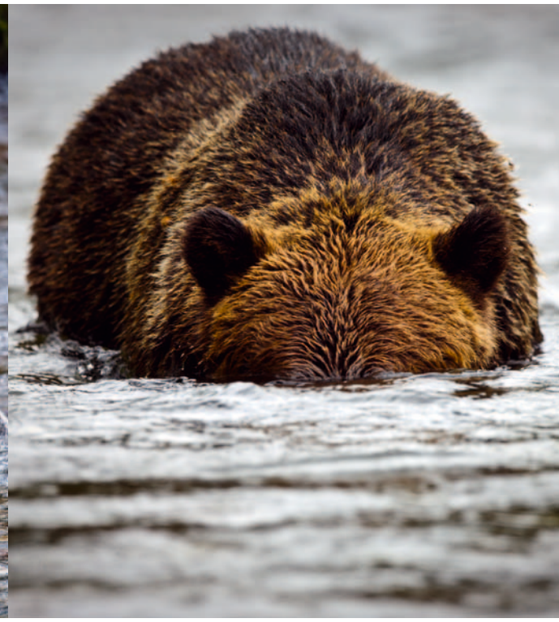
As calm returned, I examined the body of a pink salmon lying in the shallows. It was a male with the deeply hooked jaw and grotesque dorsal hump characteristic of breeding fettle. It was relatively fresh and largely intact – only the top of its skull was missing.

Then I had one of those sixth-sense moments; the sudden feeling I was being watched. As I lifted my head, I met the stare of a spirit bear (a rare pale cream form of black bear only found in the Great Bear Rainforest) standing on the opposite bank. It fixed its gaze, lifted its snout and twitched its nose as it checked my smell. Then it turned away and walked into the stream, far more intent on finding a meal.

The bear continued to work the stream, stepping from rock to rock, sniffing and picking at dead salmon along the way. Every so often, it would rush through the shallows at fish swimming upstream. More often than not, the salmon escaped, but there were so many fish in the water that sooner or later, the bear would trap one in its paws, before grabbing it in its mouth and carrying it to the shingle bank. If the fish was female, the bear would simply stand on the silvery body, ejecting a jet of red spherical eggs from its vent as if squeezing a toothpaste tube, then lap up the nutritious bounty; if the fish was male, the bear just bit off the top of the head, ate the fatty brain, then discarded the rest.

Sitting in this primordial forest, surrounded by towering hemlock, cedar and spruce and watching this bear in such a relaxed, intimate way, it was





easy to imagine I was witnessing an ancient scene untouched by humanity's influence. But even this apparently pristine wilderness is suffering – and the key is the salmon.

BEAR HAIR

It's no secret that bears – both black and grizzly – in the Pacific Northwest feast heavily on the autumn salmon runs, but the extent and depth of the bear–salmon nexus is only just beginning to become apparent.

For the past decade, British Columbia's provincial government has conducted autumn helicopter surveys in the Bella Coola region, but last year, it recorded below-average numbers of grizzly adults and cubs. This suggested that the poor salmon returns of previous years (the runs of 2008 were extremely poor) had taken their toll, starving the bears of their primary pre-hibernation food source. Without the necessary body reserves, sows fail to produce cubs (they may die in utero), or if they do manage to give birth, cub survival is less likely. The equation is simple: the more fish, the more grizzly bears that can be supported. Remove the salmon, and bear numbers will drop.

I visited the Bella Coola valley for the first time in September last year, primarily to photograph the grizzlies that fish along the Atnarko River. My heart sank when the local guides told me that bear numbers were dramatically down on previous years, almost certainly because the salmon runs the previous year had been so poor. They even showed me photos from autumn 2008 of several grizzlies, including sows and cubs, in close proximity to one another, grazing on the lawns of the lodge where I was staying: an unprecedented situation precipitated by the lack of fish and the bears' consequent hunger.

'It's common sense that bear numbers and productivity are proportional to the salmon food base,' says Dr Chris Darimont of Raincoast, a BC-based conservation group. But, he continues, 'it's only through protracted studies that any real insight will be gained and longer-term trends will become apparent'.

A carnivore specialist, Darimont spent several years studying the coastal wolf populations of the Great Bear Rainforest but has now turned his attention to bears, especially grizzlies, and their relationship with salmon. Remarkably, all he needs to piece together significant parts of the jigsaw is some bear hair. The difficult part is collecting it.

Using an aromatic concoction of fermented cow's blood and pureed fish guts as bait, Darimont lures bears into simple 'snag-traps', where rings of barbed wire catch tufts of guard hairs from their fur. Using sophisticated techniques normally associated with forensic science, he is able to accumulate an unprecedented amount of information. 'The fur's DNA is sequenced to divulge species, gender and the number of individuals,' he explains. 'With these data alone, we can track bear numbers over time and see how they fluctuate with salmon numbers over time.'

In addition, he and his colleagues have used stable-isotope analyses on the hair to estimate just how much salmon each bear consumed during the previous year's run. Finally, information on the bears' hormonal state is extracted from the samples: cortisol gives a picture of stress levels, thyroxine provides an index of protein deprivation or starvation, and sex hormones provide insights into whether or not a female has had cubs in the past year.

Last year, Darimont's team collected 550 hair samples from their study area. 'We're hoping to get an intimate insight into the relationship between grizzly bear populations, their health, and salmon consumption,' he says. By understanding these relationships, Darimont hopes to eventually be able to determine whether there is a threshold of the spawning salmon biomass that would prevent the various bear populations in the Great Bear Rainforest from declining.

Via their after-dinner leftovers, the bears are effectively acting as nutrient conveyor belts, dispersing the nitrogen- and phosphorus-rich salmon carcasses across the forest floor like fertiliser

PICKY EATERS

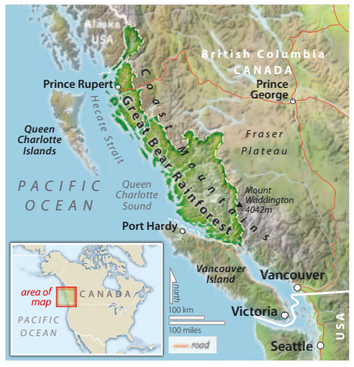
But this is just part of the story. It's now becoming increasingly clear that it isn't just the bears that need the salmon; the forests themselves, and the ecosystem as a whole, are equally reliant on the fish.

Again using techniques more often associated with crime scene investigators, scientists have found the isotopic signature of salmon in just about every component of the Great Bear Rainforest ecosystem, from the soil through to tree trunks, foliage and fruit, and on to insects and other invertebrates.

Dr Thomas Reimchen from the University of Victoria on Vancouver Island has tracked the tell-tale signs of salmon through a streamside ecosystem. Much as I had done on Gribbell Island, he sat by a stream on the Queen Charlotte Islands to closely observe feeding black bears.

Over a 45-day spawning period, he saw eight bears capture 4,281 salmon. Each bear averaged around 12 salmon a day, but only ate the prime parts rich in fat (the brain and eggs in particular). In fact, the bears caught more than 70 per cent of the fish returning to the small stream. But, crucially, 80 per cent of those taken had already spawned, so bear predation had a minimal impact on salmon productivity.

Reimchen found that bears were carrying and depositing up to 4,000 kilograms of fish corpses around a single hectare of forest adjacent to the streams.



ABOVE, LEFT TO RIGHT: the spirit bear, or Kermode bear, is a subspecies of the American black bear found only in the forests of British Columbia's west coast. About ten per cent of the population has white or cream-coloured coats, the result of a recessive gene that's common in the population; bears will frequently only consume the energy-rich parts of the salmon they catch, such as the brain and eggs. The discarded carcasses have recently been shown to play an important role in fertilising the forest; a black bear with its prey; a grizzly bear hunts for salmon. During the height of the spawning season, salmon can make up as much as 95 per cent of a bear's diet

Via their after-dinner leftovers, the bears are effectively acting as nutrient conveyor belts, dispersing the nitrogen- and phosphorus-rich salmon carcasses across the forest floor like fertiliser, and consequently providing nutrition for countless other species.

Nutrients accumulated by the salmon in far-flung corners of the northern Pacific Ocean effectively fuel the coastal forest ecosystems of British Columbia. Or, as Reimchen puts it: 'As we lose either bears or salmon – or both – along the coast of British Columbia, then we're also adversely affecting the health of the forests.' Consequently, there is almost universal agreement that the loss of salmon could be catastrophic.

BIG NEWS

But what of the salmon themselves? Five species of Pacific salmon breed in the rivers of British Columbia: Chinook, coho, chum, sockeye and pink. All have been, and continue to be, heavily exploited commercially. Between 1995 and 2005, commercial catches were the lowest on record, and salmon are now considered extinct in more than 140 watersheds throughout the province. Indeed, the abysmal sockeye run last summer in the iconic Fraser River (where only about seven per cent of the predicted nine million fish returned) was such big news that it precipitated a federal inquiry into the fish's disappearance (a report is due next May). Similarly, pink and chum salmon runs along the province's central coast have also dropped alarmingly in recent years.

It's likely that there are several factors underpinning these declines, but overexploitation by commercial fisheries and the negative impact of fish farms (which convey disease and sea-lice infestations to wild stocks) are likely culprits. And this worrying decline naturally raises questions about the long-term welfare of coastal bear populations that rely on the salmon. G

ABOVE: the Great Bear Rainforest represents one of the world's largest remaining tracts of intact temperate rainforest, covering an area of around 64,000 square kilometres. Located on British Columbia's west coast, it stretches from Vancouver Island north to the border with Alaska

Salmon on the menu

It's very difficult to quantify accurately just how pivotal salmon are to the well-being of the Pacific Northwest. Like the radiating strands of an intricate web, their influence is far-reaching – a study in Washington and Oregon pinpointed 138 species of terrestrial and marine vertebrates that feed on or are nourished by salmon. Of those, nine were deemed to be so dependent on salmon that their, 'distribution, viability, abundance and population status', are decided by the fishes' availability.