

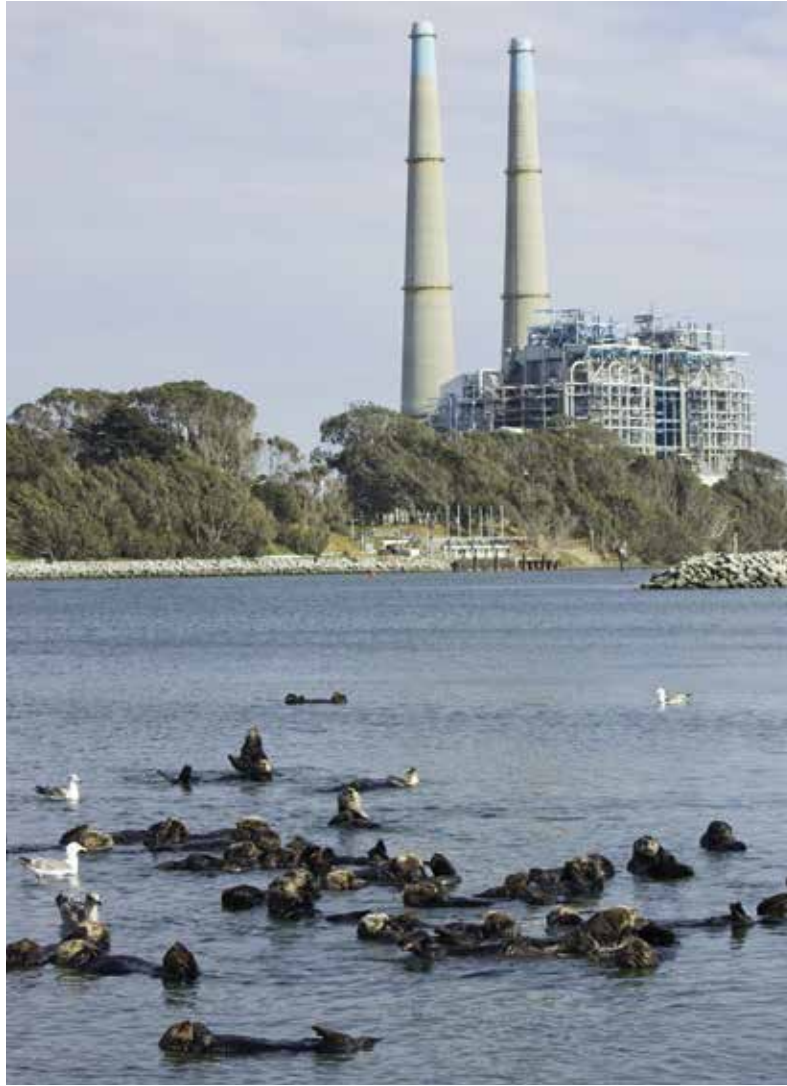
North America's sea otters can have as big an impact on coastal ecosystems as beavers do on land. This picture shows a mother with a three-day-old baby in Monterey Bay, California.



Eco engineers

Photos by Suzi Eszterhas

The spectacular return of sea otters along the west coast of North America has led to the rebirth of kelp forests and other threatened habitats. The secret? Their appetite for shellfish, says Isabelle Groc.



A raft of sea otters laze in front of the power station at Moss Landing, California – one of the best places to see them.

For the past 30 years, Jane Watson has witnessed one of the most extraordinary underwater transformations. Year after year, on the west coast of Vancouver Island in British Columbia, she has been diving at the same sites, watching areas known as ‘sea urchin barrens’ transform into beautiful forests of 2m-tall kelp. The difference between the two environments is striking.

Watson is an ecologist at Vancouver Island University with a particular interest in kelp forests. Whenever she explores a sea urchin barren, she finds herself floating in a pink world due to the overwhelming presence of pink coralline algae. Invertebrates such as sea urchins, abalone, chitons and sea cucumbers, which thrive in the open, are all easy to see. “It’s like being on a grassland because it is an exposed environment,” Watson says. In stark contrast, diving among the waving brown kelp is like hiking in a forest teeming with juvenile fish.

Behind this transformation is the voracious appetite of an extraordinarily photogenic creature – the sea otter *Enhydra lutris*. It occurs in western North America and the far east of Asia, and as its name suggests is entirely marine. (Confusingly, though, it is not the only otter found in coastal waters – the Eurasian otter *Lutra lutra* also thrives on seashores and sea lochs, for example.)

Urchins are the sea otter’s favourite food, and when the species arrives in an area dominated by urchins, it gets to work immediately. “After the urchins are eaten



SMASH AND GRAB TOOL USE IN SEA OTTERS

Sea otters are among the handful of non-primates known to use tools (others include dolphins, crows and octopuses). These otters are famous for wielding rocks, empty shells or other objects as a hammer or anvil to break open hard-shelled invertebrates, often holding onto a favourite tool by tucking it under their armpit when diving. Researchers can easily observe otters using tools since they return to the surface and float on their backs while processing their catch.

A recent study found that type of prey is what drives the otters’ tool use. They mainly deploy tools for opening marine snails, and since southern sea otters in California have the highest percentage of snails in their diet, they use tools most often.

“Without help, sea otters cannot make an efficient living by eating snails. It is too difficult, requires too much energy and results in tooth damage,” explains Tim Tinker, a wildlife biologist with the US Geological Survey and one of the authors of the study. “But with a tool they can access this food source quickly.”

Sea otters feed at the surface so are easy to study.



by otters, you can see the kelp growing back in two weeks. It can be a very fast process,” Watson notes. On the other hand, without predatory sea otters to keep them in check, the herbivorous urchins soon graze the kelp to virtually nothing. This is how British Columbia’s sea urchin barrens came into being – the sea otters had been wiped out by hunting. No sea otters, no kelp forests.

BACK FROM THE BRINK

Sea otters were wiped out in British Columbia by the 19th-century fur trade. But in the late 1960s and 70s, 89 otters were reintroduced from Alaska to the west coast of Vancouver Island. They have since reproduced and expanded their range, and the population in the province is now almost 7,000 strong – in fact sea otters are doing so well here that in 2009 Canada downlisted the species from ‘Threatened’ to ‘Special Concern’.

Just by being sea otters, they trigger dramatic ecological changes. Unlike other marine mammals, they do not have blubber to keep them warm in the cold waters of the Pacific Northwest. Instead they depend on their thick, luxurious fur coats (the thickest of any mammal) for insulation. The consequence of this unique adaptation is that their energetic requirements are very high – they have to eat up to 33 per cent of their body mass daily.

Ecologists are now discovering the far-ranging benefits that these keystone predators bring to the table. One study has found that kelp forests are nearly 20 times

larger on the west coast of Vancouver Island after otters eliminated urchins. Not only do kelp forests provide a productive and diverse nursery habitat for fish such as juvenile rockfish, they also slow down water flows and ensure that larvae from a variety of invertebrates such as abalone stay and grow in the kelp, rather than being swept away by currents to inhospitable habitats. Kelp forests also help reduce coastal erosion and play a role in controlling atmospheric carbon levels.

“We need sea otters more than they need us,” says Tim Tinker, a wildlife biologist with the US Geological Survey. “Having the otters back as a functioning component of marine ecosystems is good for the ecosystems and good for us, as we rely on the ecosystems in so many ways.”

Tinker studies sea otters in California, where they were also hard hit by the fur trade. The state once had 15,000–20,000 sea otters, but this population had crashed to just 50 individuals off Big Sur by the early 20th century.

Since receiving protection under the International Fur Seal Treaty in 1911, the otters have steadily expanded north and south along the coast of central California.

Today there are roughly 3,000 sea otters in the region, and as their numbers grow, Tinker has been surprised ▶

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BRINGING UP BABY: MATERNAL CARE

Uniquely among the world's 12 otter species, sea otters give birth in the water. A mother floats on her back to nurture her young, holding the infant snugly on her chest to nurse it. The youngster suckles for five to eight months, until almost adult size.

It's exhausting to be a mother sea otter, which is why most bear one pup at a time – twins are rare – and don't give birth every year.

In addition to producing milk, a mother has to spend extra time looking for food. A recent study found that daily energy demands faced by a sea otter mother in California increase by 17 per cent after giving birth. By the time the pup is weaned, mum's energy demands are 96 per cent higher.

Sea otter mothers can become so weak and run down that they are at risk of developing 'end-

lactation syndrome', which can be fatal as it leads to susceptibility to disease. "Some females put so much energy into their pups that they can't recover afterwards," says Melissa Miller of the California Department of Fish and Wildlife. "It's similar to running out of gas."

Truly these are some of the most devoted and hard-working mothers on the planet.



by the sheer scale of their impact. These super-industrious ecosystem engineers have high site fidelity, a ferocious appetite and live their entire lives in small areas, so are capable of exerting a major influence on local ecosystems in most unanticipated ways. "The sea otter is the one predator that comes in and completely reduces populations of a few key species," Tinker says.

COASTAL REGENERATION

A good example of this can be seen at Elkhorn Slough, a major estuary in California's Monterey Bay where Suzi Eszterhas took many of the stunning photographs on these pages. A few years ago, Tinker and his colleagues noticed how healthy and green some of the eelgrass beds looked in the Slough. Eelgrass beds are shrinking in many estuaries, partly because of excessive nutrients from agricultural run-off that promote the overgrowth of algae on the eelgrass. But not here. Tinker and his team discovered a chain reaction in the food-web that began with the otters' comeback.

The otters caught vast numbers of crabs, and with fewer crabs to eat them, grazing invertebrates such as seaslugs in turn became more abundant and nibbled

Below: a rare image of a sea otter preying on a grebe. Suzi Eszterhas was able to capture the unusual behaviour during a photographic project lasting several years.

algae off seagrass leaves, ultimately reinvigorating the entire seagrass ecosystem. "I always thought of sea otters as predators of the outer coast," Tinker says. "But Elkhorn Slough demonstrates an entirely new keystone role for otters in estuaries that we had no idea about."

Tinker is now studying the relationship of sea otters with saltmarshes in the estuary. He has found that as the otters eat burrowing crabs, the saltmarshes get healthier. These findings suggest that as sea otters recolonise other estuaries in California, they could play a crucial role in restoring imperilled habitats there too.

Sea otters also help humans in other ways. Because they consume the same shellfish that we like to eat, and these shellfish can be sensitive to marine pollution, the otters effectively act as sentinels for the health of our coasts. "Sea otters are like a mirror, showing us the impact of things we're putting in the water," explains Melissa Miller, a wildlife pathologist at the California Department of Fish and Wildlife.

A few years ago Miller discovered that 21 sea otters had died of microcystin intoxication. The toxin was produced by an algal bloom that originated in a freshwater lake and travelled downstream into the ocean, where

Top: sea otters may come ashore, here at California's Elkhorn Slough estuary, but are awkward on land. Above left: an otter uses its forepaws to block out the sun's rays. Above right: Tim Tinker examines the teeth of a captured sea otter as part of a long-term study.

it was absorbed by the shellfish that the sea otters ate. The discovery was a wake-up call for the water authorities, which prompted by scientific data provided by the otter researchers took steps to clean up the lake.

RIVAL APPETITES

The relationship between sea otters and people is not always an easy one. For while many view the otters' return as a great environmental success story, ecological changes triggered by these endearing animals come at the expense of shellfish fisheries.

When sea otter populations were historically low, the booming stocks of abalone, clams, crabs and urchins created a welcome harvest for North America's native peoples and commercial fishers. Now, in all the places where otter numbers are expanding, from Alaska to California, their appetite causes conflict with the people

who have become dependent on shellfish for their economic as well as cultural value.

"By the time sea otters arrive, it takes about two years before you can't fish there any more,"

says Mike Featherstone, president of the Pacific Urchin Harvesters Association. "In the second year, you find nothing but broken urchins. We know there will be no urchin fishery eventually. Otters are like a rat in the sea – they eat everything, but luckily for them they are cute."

Tensions are running particularly high in the abalone fishery. In British Columbia northern abalone is listed as Endangered, and so is black abalone in California. Abalone fishermen blame the demise of abalone on sea otters, even though overfishing is thought to be primarily responsible for the plight of these invertebrates.

Researchers have demonstrated that the otters do not drive abalone to extinction – instead they influence their prey's abundance, size and behaviour. In the absence of otters, abalone grew big and settled in the open where human fishers could easily harvest them. But where otters hunted them, the invertebrates avoided predation by moving to greater depths and hiding in crevices; over time the abalone even get thinner to fit narrow cracks.

In California, a study led by Tim Tinker showed that black abalone actually occurred at higher densities in the very places where sea otters had been present longest. One possible explanation for this unexpected result is that as otters eat urchins and promote kelp growth, they indirectly provide more food for the grazing abalone. ▶





“Abalone and sea otters are not enemies: they truly co-evolved and depend on each other,” says Lilian Carswell of the US Fish and Wildlife Service, an expert on sea otter ecology. While shellfish harvesters may lose out to otters in the short term, the long-term benefits that otters provide will eventually outweigh the pain that some coastal communities feel now. “It is shocking for people to see how the marine environment changes when sea otters first turn up,” Carswell acknowledges. “But the hope is that over time people forgive, forget and move on.”

ANCIENT EVIDENCE

In British Columbia Iain McKechnie, an anthropologist at the University of Victoria, is looking into the past for evidence that First Nations communities and sea otters lived in balance long before the fur trade. By examining sea otter bones dating back 5,000 years found in archeological middens, he has concluded that these native peoples hunted otters and kept them away from specific shellfish-harvesting areas near village sites.

“These people would actively hunt otters to prevent parts of their clam-digging beaches from being targeted, as the otters would otherwise eat all of the clams there, just like a deer that gets into your garden,” McKechnie says. Perhaps these traditional management practices could now guide First Nations people as they find ways to live with the burgeoning population of sea otters.

Today, while people adjust to the reality of the sea otters’ spectacular return, the animals also face a variety of other threats. A large oil spill would be devastating, despite state-of-the-art facilities to rescue oiled otters. “It would be a terrible tragedy and the proportion of oiled otters you can save is small,”

HOW TO SEE SEA OTTERS

- If you want to find sea otters yourself, California’s top locations are **Monterey Bay** – especially near Monterey Bay Aquarium, Elkhorn Slough National Estuarine Research Reserve and Moss Landing Harbor – and **Point Lobos State Marine Reserve** in Carmel. Further north, in Washington state, you will also find sea otters in **Olympic National Park**, though views can be distant.
- Wildlife tour companies offering sea otter watching in Monterey Bay include **Naturetrek** (01962 733051,

www.naturetrek.co.uk) and **Speyside Wildlife** (01479 812498, www.speysidewildlife.co.uk) as well as numerous local operators.

- In Canada and Alaska, sea otters are often best seen from the water. Companies offering cruises include **Reef & Rainforest** (01803 866965, <http://reefandrainforest.co.uk>) and **Wildlife Worldwide** (01962 302086, www.wildlifeworldwide.com). Or take a kayak tour like those run by **Kingfisher Wilderness Adventures** (020 3239 7378, <http://kingfisher.ca>).

Top: sea otters can become very approachable, as here at Moss Landing Harbor, pictured with some California sealions.

says Carswell. Then there is the threat posed by rising ocean temperatures, leading to more frequent algal blooms that put sea otters at higher risk of exposure to domoic acid, which can be fatal. In California, meanwhile, one of the main causes of death in sea otters is predation by great white sharks. Shark attacks have dramatically increased over the past 10 years in the south of the otters’ range. “This is now a real impediment to sea otter recovery,” says Carswell.

Yet despite these problems there is real excitement about the sea otters’ recovery and their massive potential as ecosystem engineers. Carswell dreams about what might happen if one day they recolonised their entire historic range. “When sea otters return, there are all kinds of ecological connections that we couldn’t possibly have imagined,” she says. “So what else are we missing? What other magical connections might be restored if sea otters return to some of their former haunts?” 🐾

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ISABELLE GROG is an environment writer: www.tidelife.ca. Enjoy more of *Suzi Eszterhas’* sea otter photos at www.discoverwildlife.com

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