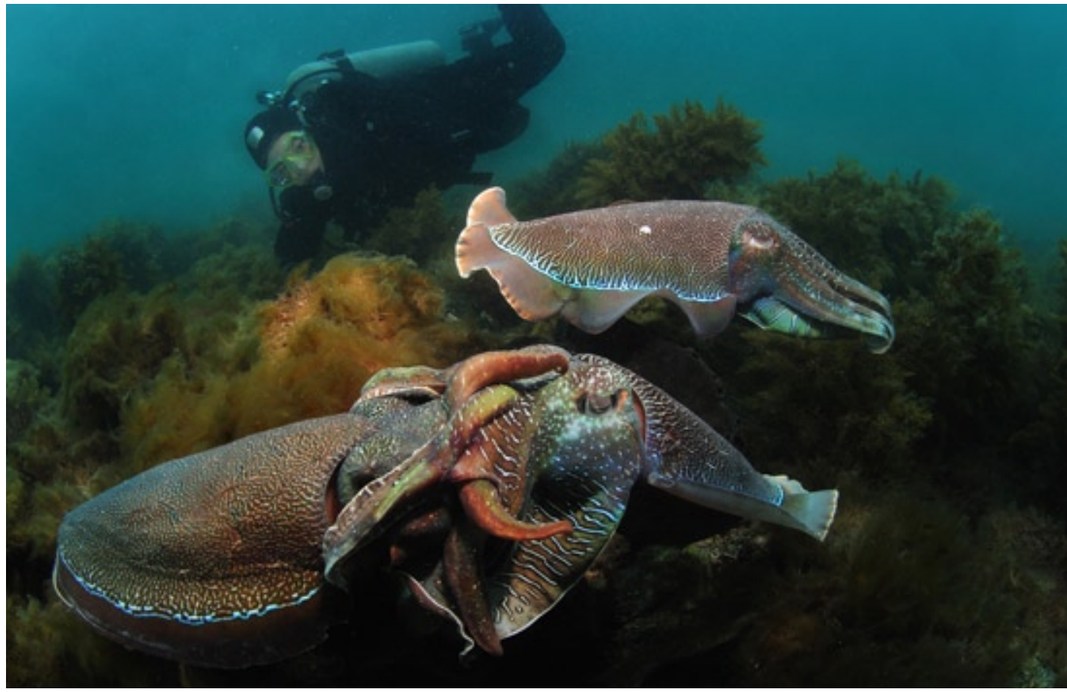
Communing with the Cuttlefish

One of Australia's most unique underwater events is facing a new challenge. The Australian giant cuttlefish mating aggregation—the world's only large-scale cuttlefish gathering—has seen the first major decline in numbers since the event was protected from commercial fishing nearly 14 years ago. Warmer than average water temperatures are believed to be the cause, and with the construction of a desalination plant becoming increasingly likely, the future of this rare phenomenon is in jeopardy, Seanna Cronin reports.



Text and photos by Seanna Cronin

Each winter the sleepy industrial town of Whyalla becomes a bustling regional center. Divers, scientists, documentary filmmakers and tourists armed with snorkel gear flock to the dusty red South Australian mining town to see one of the world's most unique marine spectacles. Each winter thousands of Australian giant cuttlefish (*Sepia apama*) migrate from the reaches of the Upper Spencer Gulf to the shallow rocky reef between Fitzgerald Bay and False Bay to participate in the penultimate event of their short lives. The annual gathering, starting in May and ending in August, is their one chance to mate and pass on their genes to the next generation.

It's a three-month marathon of competition and complex courtship, which sees these normally solitary and shy animals gather in concentrations as high as one cuttlefish per square metre. The cuttlefish throw caution to the wind in their attempts to mate, completely ignoring divers and snorkelers.

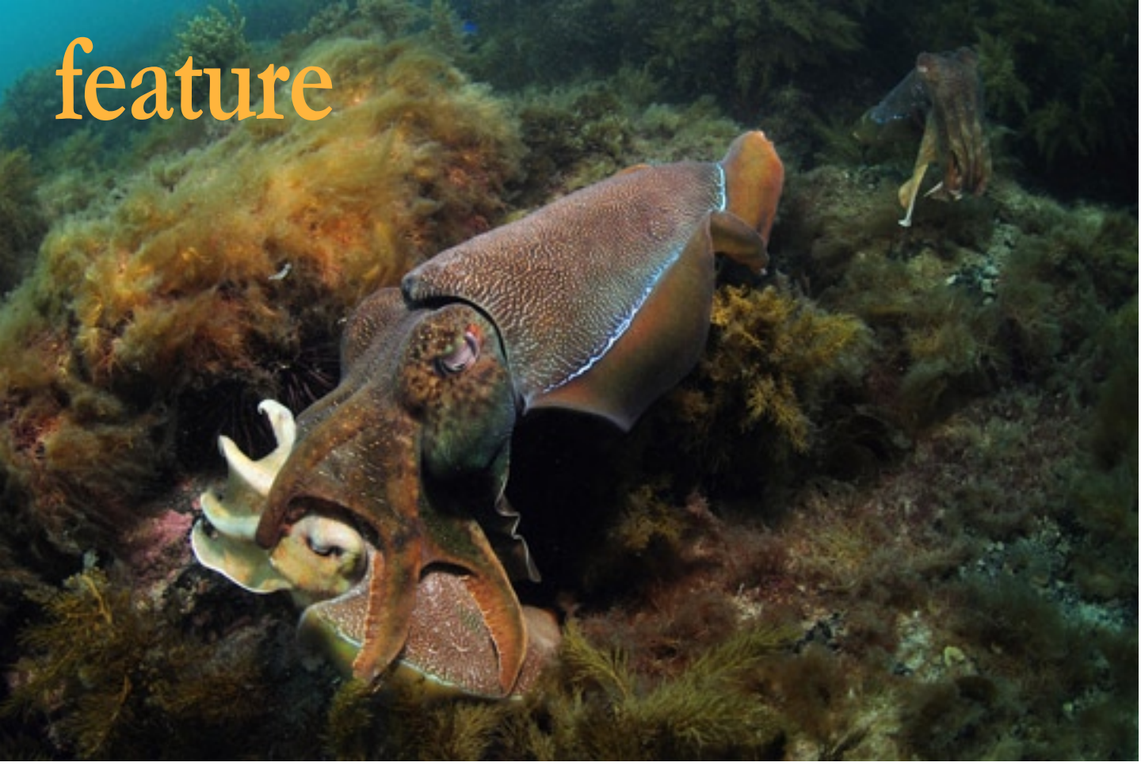
In just a few metres of water, smaller males can be observed outsmarting their stronger rivals by cross dressing as females. It's a sneaky but effective strategy, thanks to the amazingly diverse array of colors, patterns and textures made possible by specialized skin cells called chromatophores.

CLOCKWISE FROM TOP LEFT: A male does his best to guard a female he recently mated with from other males; Distracted by their need to mate, the cuttlefish allow divers to get very close; Australian giant cuttlefish use their specialised chromatophores to communicate and blend in with their surroundings

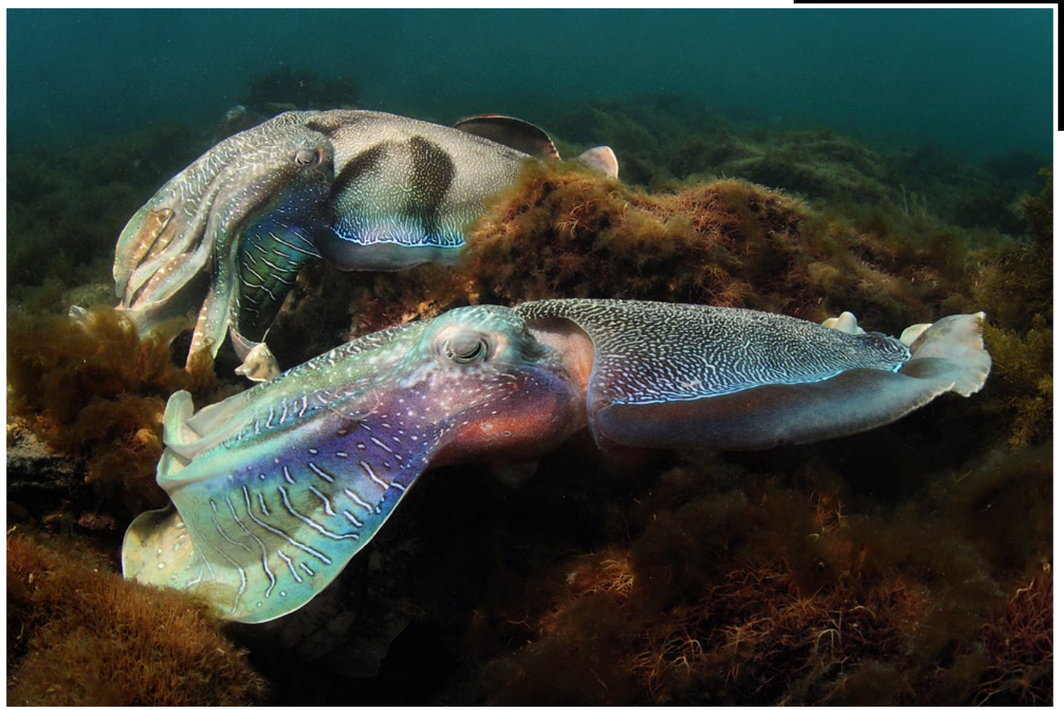
Whyalla Diving Services owner, Tony Bramley, knows the cuttlefish better than anyone. He has been nicknamed, the Godfather of Cuttlefish, because of his experience diving with the mating aggregation since 1979.

Bramley estimates only 20 percent of the cuttlefish from the 2010 season were seen in 2011. In the early 1990's there was a small amount of fishing during the mating season, mostly for bait, but when demand for cuttlefish in Asia ramped up in the mid '90s the aggregation was specifically targeted by commercial fishing operations.

Bramley and other divers successfully campaigned for protection for the cuttlefish after the aggregation was nearly fished out in 1998. The number of cuttlefish at the annual mating aggregation has been steadily



Cuttlefish



CLOCKWISE FROM TOP LEFT: A male gets a bit rough with a female when she tries to sneak off after mating; Cuttlefish locked in their lovers' embrace as the male passes spermatophores to the female; Cuttlefish lay their ping pong ball-sized eggs under rocky ledges; Two large males put on a dramatic display as they try to impress nearby females

increasing ever since.

The 2005, 2006 and 2007 events were bumper seasons, still not as abundant as when Bramley first started diving with the cuttlefish, but a healthy increase on the first official government counts of 2002. There was a slight dip in 2008, and the 2009 and 2010 seasons appeared to plateau but showed no signs of decrease or widespread ill health in the population.

This past year's season was the first time cuttlefish numbers had declined significantly since intensive commercial fishing in 1998. Bramley believes warmer than average water temperatures are the most likely culprit.

"There was no difference to any activity that I know of in the gulf last year," he said. "It's not like there was some development or dredging or new industry coming online. As far as I know, other than the temperature difference, it was just another season. Right up into the middle of June the water temperature was up around 17°C. Normally, it gets below that by May."

The giant cuttlefish in the Upper Spencer Gulf are particularly vulnerable to fishing and other pressures, like increased water temperatures, because of their dense concentrations during the mating season and their short life cycle.

After hatching, juvenile cuttlefish move out into the gulf where they lead solitary lives, taking shelter under ledges from predators such as dolphins. Less than a year later, they return to the shallow rocky reef of their birth to mate and then die shortly afterwards. Thus, each year's population is directly dependent on the success of the previous year's aggregation. The fewer adults that are able to mate, or the less eggs that survive to hatching, the fewer adults there will be to mate the following year.

"Those two years where we had full com-

Cuttlefish

CLOCKWISE FROM FAR LEFT: A moment of cuttlefish intimacy; The regional town of Whyalla. Whyalla is known as the place where the South Australian outback meets the sea; Divers and snorkelers must negotiate Point Lowly's rocky shore to see the cuttlefish

mercial fishing, in 1997 and 1998, the flow-on effect was really noticeable right up through 2002," Bramley said. "There was no recruitment in those two years."

There is hope that since the cuttlefish successfully recovered from those fishing pressures, they should also be able to bounce back from last year's unseasonably warm temperatures. But that's only if temperatures return to the normal 12-15°C range, and while fishing efforts can be regulated, it's much harder to do anything about water temperature.

"It's very worrying, but we'll know a lot more at the beginning of this season," Bramley said.

Man-made threats

Last year's disappointing season came just a few months before the approval of the expansion of BHP Billiton's Olympic Mine Dam, which increases the chances of a desalination plant being built at Point Lowly —ground zero for cuttlefish.

"The Point Lowly area is one of the few areas in the Upper Spencer Gulf that has rocky reef habitat that's suitable for Australian giant cuttlefish to lay their eggs," said Dr Bronwyn Gillanders from the University of Adelaide.

BHP was under pressure to find an alternative location for the desalination plant to protect not only the cuttlefish but the overall health of the gulf, which is also an important nursery for South Australia's snapper. Yellowtail kingfish are also thought to migrate to the Upper Spencer Gulf annually as part of their spawning migration.

"That whole gulf region is quite unique," said Gillanders. "It's referred to as a reverse estuary, which means that it's got much higher salinity at the head of the estuary and then you get to marine salinities out towards the mouth."

The South Australian and federal governments approved the expansion, which would be a multi-billion dollar economic boost for the area, in October but imposed 150 conditions. Divers and conservationists are now waiting to see what BHP decides. The mining giant is expected to make its final decision by the middle of this year. If the desalination plant goes ahead at Point Lowly, then it could make it harder for the gulf's cuttlefish population to recover from last year's drastically smaller mating aggregation.

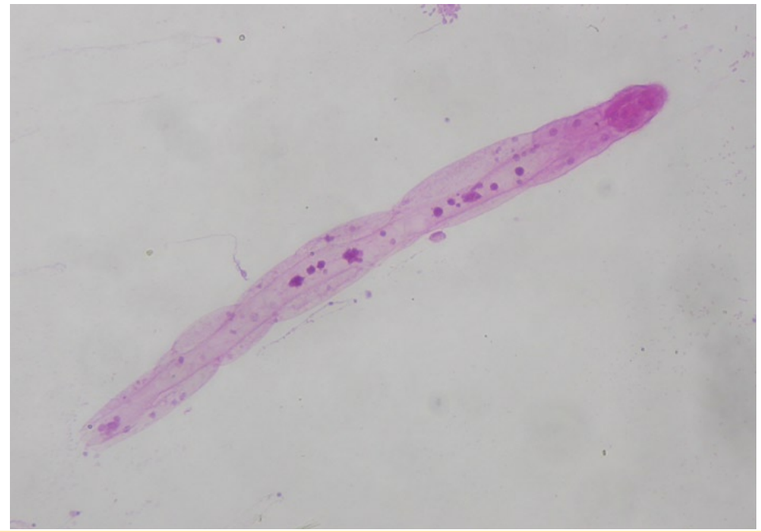
In her research, Gillanders found that even small increases in salinity negatively affect the survival of cuttlefish eggs. Increasing the salinity from the gulf's current levels of 38 to 40 parts per thousand to 50 parts per thousand in the laboratory resulted in total mortality of the eggs.

"Each generation is totally dependent on the previous generation," Gillanders said. "So if you have reduced numbers up there then potentially you'll get reduced numbers the following year, so it becomes a slippery slope of decreasing numbers."

There are concerns the desalination plant, and the dredging required for deep-water access for ships to transport the mine's copper and uranium, could also negatively affect the gulf's aquaculture industry as well as the seasonal tourism generated by the cuttlefish.

Cuttlefish

Location of Spencer Gulf in South Australia on global map (left); The popular dive site of Stony Point near Point Lowly (below); A glass side of a stained dicyemid parasite viewed under a compound microscope (bottom)



CLOCKWISE FROM ABOVE: Divers need not go far or deep to witness a range of behaviors including mating at the annual aggregation (above); University of Adelaide PhD student, Sarah Catalano, collecting sediment samples at Stony Point (right)

Ongoing research

If the Upper Spencer Gulf's population of cuttlefish can be shown to be genetically distinct from other giant cuttlefish, then there would be greater need for more protections of the mating aggregation.

Adelaide University PhD student, Sarah Catalano, is using parasites to find out more about the population structure and species status of the Australian giant cuttlefish in southern Australian waters.

Dicyemid mesozoan parasites are found in the kidneys of cephalopods and generally each species of parasite only infects one host species. So, by studying the genetics of the parasites found in Australian giant cuttlefish, Catalano should be able to show if the cuttlefish of the Upper Spencer Gulf are more genetically distinct than previously thought.

A genetic study by Gillanders, one of Catalano's supervisors, and Dr Steve Donnellan from the South Australian Museum showed that the cuttlefish from the Whyalla mating aggregation were a distinct gene pool from their Lower Spencer Gulf counterparts. Catalano's research, which continues this year, could provide further evidence towards the genetic separation of this population. The South Australian Research and Development Institute (SARDI) will also be carrying out more research at Whyalla this year.

After divers observed the unexpected drop in cuttlefish numbers last year, researchers from SARDI came to Whyalla in September to take DNA samples from the remaining cuttlefish. The South Australian government has given SARDI a $115,000 grant to gather more data at this year's mating aggregation.

As for the future of the cuttlefish, the next few months will be a waiting game. The flow-on effect of last year's drop will become evident as cuttlefish begin to gather in late May or early June. And sometime during the mating season, BHP should also announce its decision on the Olympic Dam Mine expansion. In many ways, 2012 is shaping up to be the year that makes or breaks this remarkable natural event. ■