

NORTHWEST

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Crab larvae with pitted shells linked to ocean acidification

By HAL BERTON
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Ocean acidification is damaging the shells of young Dungeness crab in the Northwest, an impact that scientists did not expect until much later this century, according to new research.

A study released this week in the journal *Science of the Total Environment* is based on a 2016 survey of Oregon, Washington and British Columbia coastal waters that examined larval Dungeness. The findings add to the concerns about the future of the

Dungeness as atmospheric carbon dioxide — on the rise due to fossil-fuel combustion — is absorbed by the Pacific Ocean and increases acidification.

“If the crabs are affected already, we really need to make sure we start to pay attention to various components of the food chain before it is too late,” said Nina Bednarek, the lead author among 13 contributing scientists. The study was funded by the National Oceanic and Atmospheric Association (NOAA). Dungeness sustain West Coast

commercial seafood harvests typically worth more than \$200 million annually, and are a mainstay for tribal and recreational crabbers. They have thrived in coastal waters that in recent years have been found to have hot spots of ocean acidification. This is due to periodic strong upwellings of deeper ocean water rich in carbon dioxide and surface waters that also have absorbed gas released by fossil-fuel combustion and other human activity.

See > **CRAB, A11**



Dungeness crab stocks could drop 30% by 2063, according to a 2017 study, based on expected declines in their food sources.

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< Crab

FROM A9

"This makes our region very unique," said Richard Feely, a senior scientist at NOAA's Pacific Marine Environmental Laboratory and a co-author of the new study.

Research published in 2014 showed ocean-acidification harm to West Coast pteropods, small free-swimming snails that are food for Dungeness crab. And a laboratory study of Dungeness crab larvae released in May 2016 by the NOAA Northwest Fisheries Science Center showed that increased ocean acidification could also jeopardize the crab.

Bednarsek, Feely and their colleagues — for the first time — documented that some Dungeness larvae in the wild already had pitted and folded shells, described in their journal article as "severe carapace dissolution," and that these larvae were typically smaller in size.

"We were really surprised to see this level of dissolution happening," Bednarsek said.

They also found damage to hairlike structures that act as sensory receptors, and the researchers hypothesize this could lead to slower movements, im-

paired swimming and other problems.

A 2017 study, based on expected declines in some Dungeness food as ocean-acidity levels change, forecast these West Coast crab stocks could be about 30% lower by 2063, although they would fluctuate from

year to year.

The authors of this new study say more research is needed to understand what the new findings may mean for the future of the Dungeness crab as the Pacific coastal waters continue to absorb more carbon dioxide.

"This sets us off in a new direction," Feely said.

The larvae they sampled did not include any from Puget Sound, which Feely says has areas that are particularly vulnerable to ocean acidification.

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