

[HOME](#) > [SCIENCE](#) > [VOL. 289, NO. 5487](#) > HOW SNAPPING SHRIMP SNAP: THROUGH CAVITATING BUBBLES

 **REPORTS**



# How Snapping Shrimp Snap: Through Cavitating Bubbles

MICHEL VERSLUIS, BARBARA SCHMITZ, ANNA VON DER HEYDT, AND DETLEF LOHSE [Authors Info & Affiliations](#)

**SCIENCE** 22 Sep 2000 Vol 289, Issue 5487 pp. 2114-2117 [DOI:10.1126/science.289.5487.2114](#)

    [CHECK ACCESS](#)



## Abstract

The snapping shrimp (*Alpheus heterochaelis*) produces a loud snapping sound by an extremely rapid closure of its snapper claw. One of the effects of the snapping is to stun or kill prey animals. During the rapid snapper claw closure, a high-velocity water jet is emitted from the claw with a speed exceeding cavitation conditions. Hydrophone measurements in conjunction with time-controlled high-speed imaging of the claw closure demonstrate that the sound is emitted at the cavitation bubble collapse and not on claw closure. A model for the bubble dynamics based on a Rayleigh-Plesset-type equation quantitatively accounts for the time dependence of the bubble radius and for the emitted sound.

## Register and access this article for free

As a service to the community, this article is available for free.

[LOG IN](#)

[CREATE A FREE ACCOUNT](#)

## Access the full article

View all access options to continue reading this article.

 [CHECK ACCESS](#)

ALREADY A SUBSCRIBER OR AAAS MEMBER? SIGN IN AS AN [INDIVIDUAL](#) OR VIA YOUR [INSTITUTION](#)

## Supplementary Material

File (1052273.xhtml)

[DOWNLOAD](#)

12.80 KB

File (08231205.avi)

[DOWNLOAD](#)

7.12 MB

File (08231205.gif)

DOWNLOAD | 1.85 MB

File (08231205.html)

DOWNLOAD | .30 KB

File (08231205.xhtml)

DOWNLOAD | 11.66 KB

File (08241205.avi)

DOWNLOAD | 3.52 MB

File (08241205.gif)

DOWNLOAD | 742.29 KB

File (08241205.html)

DOWNLOAD | .30 KB

File (08241205.xhtml)

DOWNLOAD | 11.66 KB

File (08241209.avi)

DOWNLOAD | 9.43 MB

File (08241209.gif)

DOWNLOAD | 1.70 MB

File (08241209.html)

DOWNLOAD | .30 KB

File (08241209.xhtml)

DOWNLOAD | 11.66 KB

File (08241211.avi)

DOWNLOAD | 3.52 MB

File (08241211.gif)

DOWNLOAD | 879.84 KB

File (08241211.html)

DOWNLOAD | .30 KB

File (08241211.xhtml)

DOWNLOAD | 11.66 KB

File (1052273.doc)

DOWNLOAD | 74.00 KB

File (1052273f1a.tif)

DOWNLOAD | 420.57 KB

File (1052273f1b.tif)

DOWNLOAD

489.88 KB

File (1052273f2a.eps)

DOWNLOAD

29.82 KB

File (1052273f2b.tif)

DOWNLOAD

2.49 MB

File (1052273f3.eps)

DOWNLOAD

70.48 KB

File (1052273f4.eps)

DOWNLOAD

122.85 KB

File (1052273video.html)

DOWNLOAD

4.59 KB

File (1052273video.xhtml)

DOWNLOAD

20.85 KB

File (53101203.avi)

DOWNLOAD

7.11 MB

File (53101203.gif)

DOWNLOAD

966.21 KB

File (53101203.html)

DOWNLOAD

.30 KB

File (53101203.xhtml)

DOWNLOAD

14.32 KB

File (53101206.avi)

DOWNLOAD

7.11 MB

File (53101206.gif)

DOWNLOAD

1.14 MB

File (53101206.html)

DOWNLOAD

.30 KB

File (53101206.xhtml)

DOWNLOAD

14.32 KB

File (audio.html)

DOWNLOAD

1.16 KB

File (audio.xhtml)

DOWNLOAD

15.72 KB

File (contact.html)

DOWNLOAD

|

.77 KB

File (contact.xhtml)

DOWNLOAD

|

15.02 KB

File (local\_styles.css)

DOWNLOAD

|

1.33 KB

File (referee.html)

DOWNLOAD

|

2.57 KB

File (referee.xhtml)

DOWNLOAD

|

17.94 KB

File (revvideo.html)

DOWNLOAD

|

4.52 KB

File (revvideo.xhtml)

DOWNLOAD

|

21.63 KB

File (shrimp+hydro.gif)

DOWNLOAD

|

10.07 KB

File (shrimp1.jpg)

DOWNLOAD

|

14.52 KB

File (video.1.jpg)

DOWNLOAD

|

2.01 KB

File (video.2.jpg)

DOWNLOAD

|

2.99 KB

File (video.3.jpg)

DOWNLOAD

|

1.98 KB

File (video.5.jpg)

DOWNLOAD

|

2.96 KB

File (video.6.jpg)

DOWNLOAD

|

2.26 KB

File (video.7.jpg)

DOWNLOAD

|

1.77 KB

File (video.html)

DOWNLOAD

|

3.11 KB

File (video.xhtml)

DOWNLOAD

|

19.20 KB

## REFERENCES AND NOTES

- 1 R. J. Urick, *Principles of Underwater Sound* (McGraw-Hill, New York, 1983).  
[GOOGLE SCHOLAR](#)
- 2 D. H. Cato and M. J. Bell, *Material Research Laboratory Technical Report MRL-TR-91-23* (Defence Science and Technology Organisation, Sydney, Australia, 1992).  
[GOOGLE SCHOLAR](#)
- 3 Johnson M. W., Everest F. A., Young R. W., *Biol. Bull.* **93**, 122 (1947).  
[CROSSREF](#) • [PUBMED](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 4 Everest F. A., Young R. W., Johnson M. W., *J. Acoust. Soc. Am.* **20**, 137 (1948).  
[CROSSREF](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 5 Au W. W. L., Banks K., *J. Acoust. Soc. Am.* **103**, 41 (1998).  
[CROSSREF](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 6 B. Schmitz, in *The Crustacean Nervous System*, K. Wiese, Ed. (Springer-Verlag, Berlin, in press).  
[GOOGLE SCHOLAR](#)
- 7 Epifanio C. L., Potter J. R., Deane G. B., Readhead M. L., Buckingham M. J., *J. Acoust. Soc. Am.* **106**, 3211 (1999).  
[CROSSREF](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 8 Ritzmann R. E., *J. Comp. Physiol.* **95**, 217 (1974).  
[CROSSREF](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 9 B. Schmitz and J. Herberholz, in *New Neuroethology on the Move, Proceedings of the 26th Göttingen Neurobiology Conference 1998*, vol. 2, N. Elsner and R. Wehner, Eds. (Thieme, Stuttgart, 1998), p. 241.  
[GOOGLE SCHOLAR](#)
- 10 Herberholz J., Schmitz B., *J. Comp. Physiol. A* **185**, 41 (1999).  
[CROSSREF](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 11 Schein H., *Mar. Behav. Physiol.* **3**, 83 (1975).  
[CROSSREF](#) • [GOOGLE SCHOLAR](#)
- 12 Herberholz J., Schmitz B., *Biol. Bull.* **195**, 156 (1998).  
[CROSSREF](#) • [PUBMED](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 13 G. E. MacGinitie and N. MacGinitie, *Natural History of Marine Animals* (McGraw-Hill, New York, 1949).  
[GOOGLE SCHOLAR](#)
- 14 Volz P., *Z. Morph. Oekol. Tiere* **34**, 272 (1938).  
[CROSSREF](#) • [GOOGLE SCHOLAR](#)
- 15 C. E. Brennen, *Cavitation and Bubble Dynamics* (Oxford Univ. Press, New York, 1995).  
[GOOGLE SCHOLAR](#)
- 16 Video files of the snapping shrimp and links to audio files can be found at *Science Online* (available at [www.sciencemag.org/feature/data/1052273.shl](http://www.sciencemag.org/feature/data/1052273.shl)).  
[GOOGLE SCHOLAR](#)
- 17 S. Schultz, K. Wuppermann, B. Schmitz, *Zool. Anal. Complex Syst.* **101** (suppl. I), 85 (1998).  
[GOOGLE SCHOLAR](#)
- 18 Blake J. R., Tomita Y., Tong R. P., *Appl. Sci. Res.* **58**, 77 (1998).  
[CROSSREF](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 19 Ceccio S. L., Brennen C. E., *J. Fluid Mech.* **233**, 633 (1991).  
[CROSSREF](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)

- 20 Prosperetti A., Lezzi A., *J. Fluid Mech.* **168**, 457 (1986).  
[CROSSREF](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 21 Plesset M. S., Prosperetti A., *Annu. Rev. Fluid Mech.* **9**, 145 (1977).  
[CROSSREF](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 22 Hilgenfeldt S., Lohse D., Brenner M., *Phys. Fluids* **8**, 2808 (1996).  
[CROSSREF](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 23 Storey B. D., Szeri A. J., *Proc. R. Soc. London Ser. A* **456**, 1685 (2000).  
[CROSSREF](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 24 R. Tögel, B. Gompf, R. Pecha, D. Lohse, *Phys. Rev. Lett.*, in press.  
[GOOGLE SCHOLAR](#)
- 25 L. D. Landau and E. M. Lifshitz, *Fluid Mechanics* (Pergamon, Oxford, 1987).  
[GOOGLE SCHOLAR](#)
- 26 Hilgenfeldt S., Lohse D., Zomack M., *Eur. Phys. J. B* **4**, 247 (1998).  
[CROSSREF](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 27 Prosperetti A., *Q. Appl. Math.* **35**, 339 (1977).  
[CROSSREF](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 28 Hao Y., Prosperetti A., *Phys. Fluids* **11**, 2008 (1999).  
[CROSSREF](#) • [WEB OF SCIENCE](#) • [GOOGLE SCHOLAR](#)
- 29 M. Versluis, B. Schmitz, A. von der Heydt, D. Lohse, in preparation.  
[GOOGLE SCHOLAR](#)
- 30 Brooks W. K., Herrick F. H., *Mem. Natl. Acad. Sci. Wash.* **5**, 319 (1891).  
[GOOGLE SCHOLAR](#)
- 31 This work was supported by a grant from the Stichting voor Fundamenteel Onderzoek der Materie (FOM) and by a grant from the Deutsche Forschungsgemeinschaft (Schm 693/5-4) to B.S. The experimental assistance of M. Hansbauer is gratefully acknowledged. We offer special thanks to N. Franz of the electronics workshop of the Department of Physics, Technical University of Munich, for repairing our Schmitt trigger device on Christmas Eve. M.V. is supported by FOM. A.H. is supported by the German-Israeli Foundation.  
[GOOGLE SCHOLAR](#)
- 

## eLetters (0)

eLetters is a forum for ongoing peer review. eLetters are not edited, proofread, or indexed, but they are screened. eLetters should provide substantive and scholarly commentary on the article. Neither embedded figures nor equations with special characters can be submitted, and we discourage the use of figures and equations within eLetters in general. If a figure or equation is essential, please include within the text of the eLetter a link to the figure, equation, or full text with special characters at a public repository with versioning, such as Zenodo. Please read our [Terms of Service](#) before submitting an eLetter.

[LOG IN TO SUBMIT A RESPONSE](#)

---

## CURRENT ISSUE

ADVERTISEMENT

### Sign up for ScienceAdviser

Get *Science's* award-winning newsletter with the latest news, commentary, and research, free to your inbox daily.

[SUBSCRIBE](#) >



**Competition enables rapid adaptation to a warming range edge in a model plant community**

BY TAKUJI USUI, AMY L. ANGERT

**A stellar dynamical mass measurement of an inactive black hole at redshift 2**

BY ANDREW B. NEWMAN, MENG GU, ET AL.

**Spontaneous problem-solving in bumble bees**

BY AKSHAYE A. BHAMBORE, ECE N. AKMEŞE, ET AL.

[TABLE OF CONTENTS](#) >

**LATEST NEWS**

**SCIENCEINSIDER** | 8 JUN 2026

**NIH plans to cap number of grants a scientist can have at once**

**NEWS** | 8 JUN 2026

**How did so many theropod dinosaurs come to have tiny arms?**

**SCIENCEINSIDER** | 8 JUN 2026

**How novel is that research paper? Competition to quantify concept crowns winner**

**SCIENCEINSIDER** | 8 JUN 2026

**Leading supplier of research monkeys declares bankruptcy**

**NEWS** | 8 JUN 2026

**An embryo editing ‘first’ is more complicated than headlines suggest**

**SCIENCEINSIDER** | 5 JUN 2026

**Protein name confusion created antibody mix-up affecting hundreds of papers**

ADVERTISEMENT

ADVERTISEMENT

[View full text](#) | [Download PDF](#)

Science

Science  
Advances

Science  
Immunology

Science  
Robotics

Science  
Signaling

Science  
Transla  
Medic

FOLLOW US



GET OUR NEWSLETTER

NEWS

[All News](#)

[ScienceInsider](#)

[News Features](#)

CAREERS

[Careers Articles](#)

[Find Jobs](#)

[Employer Hubs](#)

COMMENTARY

[Opinion](#)

[Analysis](#)

[Blogs](#)

JOURNALS

[Science](#)

[Science Advances](#)

[Science Immunology](#)

AUTHORS & REVIEWERS

[Information for Authors](#)

[Information for Reviewers](#)

[Donate to News](#)

### Science Partner Journals

Librarian FAQs

Post a Job

## Science in the Classroom

### Prizes and Awards

Contact Us

© 2026 American Association for the Advancement of Science. All rights reserved. AAAS is a partner of HINARI, AGORA, OARE, CHORUS, CLOCKSS, CrossRef and COUNTER. *Science* ISSN 0036-8075.

[Terms of Service](#) | [Privacy Policy](#) | [Cookie Preferences](#) | [Accessibility](#)