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The noise of the hunt: Effects of noise on predator-prey relationships in a marine ecosystem

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Bibliography

Bibliography

- Aarts G, von Benda-Beckmann AM, Lucke K, Sertlek HÖ, van Bemmelen R, Geelhoed SC V, Brasseur S, Scheidat M, Lam F-PA, Slabbekoorn H, et al. 2016. Harbour porpoise movement strategy affects cumulative number of animals acoustically exposed to underwater explosions. *Mar Ecol Prog Ser.* 557:261–275. doi:10.3354/meps11829.
- Aguilar de Soto N, Johnson MP, Madsen PT, Diaz F, Dominguez I, Brito A, Tyack PL. 2008. Cheetahs of the deep sea: deep foraging sprints in short-finned pilot whales off Tenerife (Canary Islands). *J Anim Ecol.* 77(5):936–947. doi:10.1111/j.1365-2656.2008.01393.x.
- Ainslie MA. 2010. Principles of Sonar Performance Modelling.
- Ainslie MA, McCole JG. 1998. A simplified formula for viscous and chemical absorption in sea water. *J Acoust Soc Am.* 103(3):1671–1672. doi:10.1121/1.421258.
- Alberghina D, Caudullo E, Bandi N, Panzera M. 2013. A comparative analysis of the acoustic structure of separation calls of Mongolian wild horses (*Equus ferus przewalskii*) and domestic horses (*Equus caballus*). *J Vet Behav Clin Appl Res.* 9(5):254–257. doi:10.1016/j.jveb.2014.04.008.
- Alves AC, Antunes RN, Bird A, Tyack PL, Miller PJO, Lam F-PA, Kvadsheim PH. 2014. Vocal matching of naval sonar signals by long-finned pilot whales (*Globicephala melas*). *Mar Mammal Sci.* 30(3):1248–1257. doi:10.1111/mms.12099.
- Andrew RK, Howe BM, Mercer JA. 2011. Long-time trends in ship traffic noise for four sites off the North American West Coast. *J Acoust Soc Am.* 129(2):642–651. doi:10.1121/1.3518770.
- Andrew RK, Howe BM, Mercer JA, Dzieciuch MA. 2002. Ocean ambient sound: Comparing the 1960s with the 1990s for a receiver off the California coast. *Acoust Res Lett Online.* 3(2):65. doi:10.1121/1.1461915.
- Aoki K, Sakai M, Miller PJO, Visser F, Sato K. 2013. Body contact and synchronous diving in long-finned pilot whales. *Behav Process.* 99:12–20. doi:10.1016/j.beproc.2013.06.002.
- Aoki K, Sato K, Isojunno S, Narazaki T, Miller PJO. 2017. High diving metabolic rate indicated by high-speed transit to depth in negatively buoyant long-finned pilot whales. *J Exp Biol.* 220(Pt 20):3802–3811. doi:10.1242/jeb.158287.
- Ashley MC, Mangi SC, Rodwell LD. 2014. The potential of offshore windfarms to act as marine protected areas - A systematic review of current evidence. *Mar Policy.* 45(March 2019):301–309. doi:10.1016/j.marpol.2013.09.002.
- Au WWL, Giorli G, Chen J, Copeland A, Lammers MO, Richlen M, Jarvis S, Morrissey R, Moretti D, Klinck H. 2013. Nighttime foraging by deep diving echolocating odontocetes off the Hawaiian islands of Kauai and Ni'ihau as determined by passive

Bibliography

- acoustic monitors. *J Acoust Soc Am*. 133(5):3119–3127. doi:10.1121/1.4798360.
- Au WWL, Moore PWB. 1984. Receiving beam patterns and directivity indices of the Atlantic bottlenose dolphin *Tursiops truncatus*. *J Acoust Soc Am*. 75(1):255–262. doi:10.1121/1.390403.
- Baird RW, Borsani JF, Hanson MB, Tyack PL. 2002. Diving and night-time behavior of long-finned pilot whales in the Ligurian Sea. *Mar Ecol Prog Ser*. 237:301–305.
- Barber JR, Crooks KR, Fristrup KM. 2010. The costs of chronic noise exposure for terrestrial organisms. *Trends Ecol Evol*. 25(3):180–189. doi:10.1016/j.tree.2009.08.002.
- Barreto RE, Volpato GL. 2011. Ventilation rates indicate stress-coping styles in Nile tilapia. *J Biosci*. 36(5):851–855. doi:10.1007/s12038-011-9111-4.
- Barton K. 2016. dredge: automated model selection.
- Bee MA. 2007. Selective phonotaxis by male wood frogs (*Rana sylvatica*) to the sound of a chorus. *Behav Ecol Sociobiol*. 61(6):955–966. doi:10.1007/s00265-006-0324-8.
- Bejder L, Samuels A, Whitehead H, Finn H, Allen S. 2009. Impact assessment research: use and misuse of habituation, sensitisation and tolerance in describing wildlife responses to anthropogenic stimuli. *Mar Ecol Prog Ser*. 395:177–185. doi:10.3354/meps07979.
- Bejder L, Samuels A, Whitehead H, Gales N. 2006a. Interpreting short-term behavioural responses to disturbance within a longitudinal perspective. *Anim Behav*. 72(5):1149–1158. doi:10.1016/j.anbehav.2006.04.003.
- Bejder L, Samuels A, Whitehead H, Gales N, Mann J, Connor R, Heithaus M, Watson-Capps J, Flaherty C, Krützen M. 2006b. Decline in relative abundance of bottlenose dolphins exposed to long-term disturbance. *Conserv Biol*. 20(6):1791–1798. doi:10.1111/j.1523-1739.2006.00540.x.
- von Benda-Beckmann AM, Wensveen PJ, Samarra FI, Beerens SP, Miller PJO. 2016. Separating underwater ambient noise from flow noise recorded on stereo acoustic tags attached to marine mammals. *J Exp Biol*. 219(Pt 17):2774. doi:10.1242/jeb.148197.
- Benoit-Bird KJ, Moline MA, Southall BL. 2017. Prey in oceanic sound scattering layers organize to get a little help from their friends. *Limnol Oceanogr*. 62(6):2788–2798. doi:10.1002/lno.10606.
- Blair HB, Merchant ND, Friedlaender AS, Wiley DN, Parks SE. 2016. Evidence for ship noise impacts on humpback whale foraging behaviour. *Biol Lett*. 12(8). doi:10.1098/rsbl.2016.0005.
- Blom E, Kvarnemo C, Andersson MH, Svensson O, Dekhla I, Schödl S, Amorim MCP. 2019. Continuous but not intermittent noise has a negative impact on mating

Bibliography

- success in a marine fish with paternal care. *Sci Rep.* 9(5494):1–9. doi:10.1038/s41598-019-41786-x.
- Bolker BM, Brooks ME, Clark CJ, Geange SW, Poulsen JR, Stevens MH, White JS. 2009. Generalized linear mixed models: a practical guide for ecology and evolution. *Trends Ecol Evol.* 24(3):127–135. doi:10.1016/j.tree.2008.10.008.
- Branstetter BK, Finneran JJ, Green LS, Robinson EE, Tormey MN, Dear RL. 2008. Co-modulation masking release in the bottlenose dolphin (*Tursiops truncatus*). *J Acoust Soc Am.* 123(5):2985–2985. doi:10.1121/1.2932511.
- Breitburg D, Levin LA, Oschlies A, Grégoire M, Chavez FP, Conley DJ, Garçon V, Gilbert D, Gutiérrez D, Isensee K, et al. 2018. Declining oxygen in the global ocean and coastal waters. *Science.* 359(6371):eaam7240. doi:10.1126/science.aam7240.
- Bruce B, Bradford R, Foster S, Lee K, Lansdell M, Cooper S, Przeslawski R. 2018. Quantifying fish behaviour and commercial catch rates in relation to a marine seismic survey. *Mar Environ Res.* 140(February):18–30. doi:10.1016/j.marenvres.2018.05.005.
- Bruintjes R, Radford AN. 2013. Context-dependent impacts of anthropogenic noise on individual and social behaviour in a cooperatively breeding fish. *Anim Behav.* 85(6):1343–1349. doi:10.1016/j.anbehav.2013.03.025.
- Brumm H, Slabbekoorn H. 2005. Acoustic Communication in Noise. *Adv Study Behav.* 35:151–209. doi:10.1016/s0065-3454(05)35004-2.
- Buck JR, Tyack PL. 2000. Response of gray whales to low frequency sounds. *J Acoust Soc Am.* 107(5):2774. doi:http://dx.doi.org/10.1121/1.428908.
- Campbell J. 2019. Picoscope3000Logger.
- Cantor M, Shoemaker LG, Cabral RB, Flores CO, Varga M, Whitehead H. 2015. Multilevel animal societies can emerge from cultural transmission. *Nat Commun.* 6. doi:10.1038/ncomms9091.
- Carere C, van Oers K. 2004. Shy and bold great tits (*Parus major*): body temperature and breath rate in response to handling stress. *Physiol Behav.* 82(5):905–912. doi:10.1016/j.physbeh.2004.07.009.
- Carretta J V, Barlow J. 2011. Long-term effectiveness, failure rates, and “dinner bell” properties of acoustic pingers in a gillnet fishery. *Mar Technol Soc J.* 45(5):7–19. doi:10.4031/MTSJ.45.5.3.
- Carstensen J, Henriksen OD, Teilmann J. 2006. Impacts of offshore wind farm construction on harbour porpoises : Acoustic monitoring of echolocation activity using porpoise detectors (T-PODs). *Mar Ecol Prog Ser.* 321(September):295–308. doi:10.3354/meps321295.

Bibliography

- Chan AAY-H, Blumstein DT. 2011. Attention, noise, and implications for wildlife conservation and management. *Appl Anim Behav Sci.* 131(1–2):1–7. doi:10.1016/j.applanim.2011.01.007.
- Chan AAY-H, Giraldo-Perez P, Smith S, Blumstein DT. 2010. Anthropogenic noise affects risk assessment and attention: the distracted prey hypothesis. *Biol Lett.* 6(4):458–461. doi:10.1098/rsbl.2009.1081.
- Chapman C, Hawkins AD. 1969. The importance of sound in fish behaviour in relation to capture by trawls. *FAO Fish Rep.*(January 1969):717–729.
- Charnov EL. 1976. Optimal foraging, the marginal value theorem. *Theor Popul Biol* 9: 129–136. doi:10.1016/0040-5809(76)90040-X.
- Chu D. 2011. Technology evolution and advances in fisheries acoustics. *J Mar Sci Technol.* 19(3):245–252.
- Codarin A, Wysocki LE, Ladich F, Picciulin M. 2009. Effects of ambient and boat noise on hearing and communication in three fish species living in a marine protected area (Miramare, Italy). *Mar Pollut Bull.* 58(12):1880–1887. doi:10.1016/j.marpolbul.2009.07.011.
- Colbo K, Ross T, Brown C, Weber T. 2014. A review of oceanographic applications of water column data from multibeam echosounders. *Estuar Coast Shelf Sci.* 145:41–56. doi:10.1016/j.ecss.2014.04.002.
- Connor RC, Mann J, Tyack PL, Whitehead H. 1998. Social evolution in toothed whales. *Trends Ecol Evol.* 13(6):228–231.
- Dähne M, Gilles A, Lucke K, Peschko V, Adler S, Krügel K, Sundermeyer J, Siebert U. 2013. Effects of pile-driving on harbour porpoises (*Phocoena phocoena*) at the first offshore wind farm in Germany. *Environ Res Lett.* 8(2):25002. doi:10.1088/1748-9326/8/2/025002.
- David JA. 2006. Likely sensitivity of bottlenose dolphins to pile-driving noise. *Water Environ J.* 20(1):48–54. doi:10.1111/j.1747-6593.2005.00023.x.
- Dawson SM, Northridge S, Waples D, Read AJ. 2013. To ping or not to ping: the use of active acoustic devices in mitigating interactions between small cetaceans and gillnet fisheries. *Endanger Species Res.* 19(3):201–221. doi:10.3354/esr00464.
- Debusschere E, Hostens K, Adriaens D, Ampe B, Botteldooren D, De Boeck G, De Muynck A, Sinha AK, Vandendriessche S, Van Hoorebeke L, et al. 2016. Acoustic stress responses in juvenile sea bass *Dicentrarchus labrax* induced by offshore pile driving. *Env Pollut.* 208(Pt B):747–757. doi:10.1016/j.envpol.2015.10.055.
- Deecke VB, Barrett-Lennard LG, Spong P, Ford JKB. 2010. The structure of stereotyped calls reflects kinship and social affiliation in resident killer whales (*Orcinus orca*). *Naturwissenschaften.* 97(5):513–518. doi:10.1007/s00114-010-0657-z.

Bibliography

- Dekeling R, Tasker M, Ainslie MA, Andersson M, Andre M, Borsani F, Brensing K, Castellote M, Dalen J, Folegot T, et al. 2016. The European Marine Strategy: Noise Monitoring in European Marine Waters from 2014. *Adv Exp Med Biol.* 875:205–215. doi:10.1007/978-1-4939-2981-8_24.
- DeRuiter SL, Bahr A, Blanchet MA, Hansen SF, Kristensen JH, Madsen PT, Tyack PL, Wahlberg M. 2009. Acoustic behaviour of echolocating porpoises during prey capture. *J Exp Biol.* 212(19):3100–3107. doi:10.1242/jeb.030825.
- DeRuiter SL, Southall BL, Calambokidis J, Zimmer WM, Sadykova D, Falcone EA, Friedlaender AS, Joseph JE, Moretti D, Schorr GS, et al. 2013. First direct measurements of behavioural responses by Cuvier's beaked whales to mid-frequency active sonar. *Biol Lett.* 9(4):20130223. doi:10.1098/rsbl.2013.0223.
- DiRienzo N, Pruitt JN, Hedrick A V. 2013. The combined behavioural tendencies of predator and prey mediate the outcome of their interaction. *Anim Behav.* 86(2):317–322. doi:10.1016/j.anbehav.2013.05.020.
- Doksæter L, Handegard NO, Godø OR, Kvadsheim PH, Nordlund N. 2012. Behavior of captive herring exposed to naval sonar transmissions (1.0–1.6 kHz) throughout a yearly cycle. *J Acoust Soc Am.* 131(2):1632–1642. doi:10.1121/1.3675944.
- Douma JC, Weedon JT. 2019. Analyzing continuous proportions in ecology and evolution: a practical introduction to beta and Dirichlet regression. *Methods Ecol Evol.* 2019(May):2041–210X.13234. doi:10.1111/2041-210X.13234.
- Dunlop RA, Noad MJ, McCauley RD, Kniest E, Slade R, Paton D, Cato DH. 2016. Response of humpback whales (*Megaptera novaeangliae*) to ramp-up of a small experimental air gun array. *Mar Pollut Bull.* 103(1–2):72–83. doi:10.1016/j.marpolbul.2015.12.044.
- Dyndo M, Wisniewska DM, Rojano-Donate L, Madsen PT. 2015. Harbour porpoises react to low levels of high frequency vessel noise. *Sci Rep.* 5:11083. doi:10.1038/srep11083.
- Endler JA. 1992. Signals, signal conditions, and the direction of evolution. *Am Nat.* 139:S125–S153.
- Erbe C, Reichmuth C, Cunningham K, Lucke K, Dooling R. 2016. Communication masking in marine mammals: A review and research strategy. *Mar Pollut Bull.* 103(1–2):15–38. doi:10.1016/j.marpolbul.2015.12.007.
- Estes JA, Terborgh J, Brashares J, Power ME, Berger J, Bond WJ, Carpenter SR, Essington TE, Holt RD, Jackson JBC, et al. 2011. Trophic downgrading of planet Earth. *Science.* 333(6040):301–306. doi:10.1126/science.1205106.
- Falcone EA, Schorr GS, Watwood SL, DeRuiter SL, Zerbini AN, Andrews RD, Morrissey RP, Moretti DJ. 2017. Diving behaviour of Cuvier's beaked whales exposed to two

Bibliography

- types of military sonar. *R Soc Open Sci.* 4(8):170629. doi:10.1098/rsos.170629.
- Feldman HA, McMahon TA. 1983. The 3/4 mass exponent in metabolism is not a statistical artifact. *Respir Physiol.* 52:149–163.
- Fewtrell JL, McCauley RD. 2012. Impact of air gun noise on the behaviour of marine fish and squid. *Mar Pollut Bull.* 64(5):984–993. doi:10.1016/j.marpolbul.2012.02.009.
- Filiciotto F, Vazzana M, Celi M, Maccarrone V, Ceraulo M, Buffa G, Arizza V, de Vincenzi G, Grammauta R, Mazzola S, et al. 2016. Underwater noise from boats: Measurement of its influence on the behaviour and biochemistry of the common prawn (*Palaemon serratus*, Pennant 1777). *J Exp Mar Bio Ecol.* 478:24–33. doi:10.1016/j.jembe.2016.01.014.
- Filiciotto F, Vazzana M, Celi M, Maccarrone V, Ceraulo M, Buffa G, Stefano V Di, Mazzola S, Buscaino G. 2014. Behavioural and biochemical stress responses of *Palinurus elephas* after exposure to boat noise pollution in tank. *Mar Pollut Bull.* 84(1–2):104–114. doi:10.1016/j.marpolbul.2014.05.029.
- Fletcher H. 1940. Auditory Patterns. *Rev Mod Phys.* 12:47–66.
- Foote AD, Osborne RW, Hoelzel AR. 2004. Whale-call response to masking boat noise. *Nature.* 428:910.
- Ford JKB. 1989. Acoustic behaviour of resident killer whales (*Orcinus orca*) off Vancouver Island, British Columbia. *Can J Zool.* 67(3):727–745.
- Fouda L, Wingfield JE, Fandel AD, Garrod A, Hodge KB, Rice AN, Bailey H. 2018. Dolphins simplify their vocal calls in response to increased ambient noise. *Biol Lett.* 14(10):1–5. doi:10.1098/rsbl.2018.0484.
- Francis CD, Barber JR. 2013. A framework for understanding noise impacts on wildlife: An urgent conservation priority. *Front Ecol Environ.* 11(6):305–313. doi:10.1890/120183.
- Francis CD, Ortega CP, Cruz A. 2009. Noise Pollution Changes Avian Communities and Species Interactions. *Curr Biol.* 19(16):1415–1419. doi:10.1016/j.cub.2009.06.052.
- Fraser S, Williamson BJ, Nikora V, Scott BE. 2018. Fish distributions in a tidal channel indicate the behavioural impact of a marine renewable energy installation. *Energy Reports.* 4:65–69. doi:10.1016/j.egyr.2018.01.008.
- Frid A, Dill LM. 2002. Human-caused Disturbance Stimuli as a Form of Predation Risk. *Conserv Ecol.* 6(1):11.
- Frisk G V. 2012. Noiseconomics: The relationship between ambient noise levels in the sea and global economic trends. *Sci Rep.* 2(1):2–5. doi:10.1038/srep00437.
- Garton EO, Ratti JT, Giudice JH. 2005. Research and experimental design. In: Braun

Bibliography

- C, editor. Techniques for wildlife investigations and management. Bethesda: The Wildlife Society.
- Gaynor KM, Brown JS, Middleton AD, Power ME, Brashares JS. 2019. Landscapes of Fear: Spatial Patterns of Risk Perception and Response. *Trends Ecol Evol.* 34(4):355–368. doi:10.1016/j.tree.2019.01.004.
- Geffroy B, Samia DSM, Bessa E, Blumstein DT. 2015. How Nature-Based Tourism Might Increase Prey Vulnerability to Predators. *Trends Ecol Evol.* 30(12):755–765. doi:10.1016/j.tree.2015.09.010.
- Gerlotto F, Castillo J, Saavedra A, Barbieri MA, Espejo M, Cotel P. 2004. Three-dimensional structure and avoidance behaviour of anchovy and common sardine schools in central southern Chile. *ICES J Mar Sci.* 61(7):1120–1126. doi:10.1016/j.icesjms.2004.07.017.
- van Ginkel C, Becker DM, Gowans S, Simard P. 2018. Whistling in a noisy ocean: bottlenose dolphins adjust whistle frequencies in response to real-time ambient noise levels. *Bioacoustics.* 27(4):391–405. doi:10.1080/09524622.2017.1359670.
- Giorli G, Au WWL, Neuheimer A. 2016. Differences in foraging activity of deep sea diving odontocetes in the Ligurian Sea as determined by passive acoustic recorders. *Deep Res Part I Oceanogr Res Pap.* 107:1–8. doi:10.1016/j.dsr.2015.10.002.
- Gomez C, Lawson JW, Wright AJ, Buren A, Tollit D, Lesage V. 2016. A systematic review on the behavioural responses of wild marine mammals to noise: the disparity between science and policy. *Can J Zool.* 94(12):801–819.
- González Correa JM, Bayle Sempere JT, Juanes F, Rountree R, Ruíz JF, Ramis J. 2019. Recreational boat traffic effects on fish assemblages: First evidence of detrimental consequences at regulated mooring zones in sensitive marine areas detected by passive acoustics. *Ocean Coast Manag.* 168(September 2018):22–34. doi:10.1016/j.ocecoaman.2018.10.027.
- Göttsche KM, Steinhagen U, Juhl PM. 2015. Numerical evaluation of pile vibration and noise emission during offshore pile driving. *Appl Acoust.* 99:51–59. doi:10.1016/j.apacoust.2015.05.008.
- Götz T, Janik VM. 2011. Repeated elicitation of the acoustic startle reflex leads to sensitisation in subsequent avoidance behaviour and induces fear conditioning. *BMC Neurosci.* 12(1):30. doi:10.1186/1471-2202-12-30.
- Guillard J, Balay P, Colon M, Brehmer P. 2010. Survey boat effect on YOY fish schools in a pre-alpine lake: Evidence from multibeam sonar and split-beam echosounder data. *Ecol Freshw Fish.* 19(3):373–380. doi:10.1111/j.1600-0633.2010.00419.x.
- Hahn TR, Thomas G. 2008. Modeling the sound levels produced by bubble release of individual herring. *J Acoust Soc Am.* 124(3):1849–1857. doi:10.1121/1.2951593.

Bibliography

- Halekoh U, Højsgaard S. 2014. A Kenward-Roger approximation and parametric bootstrap methods for tests in linear mixed models - The R package pbrtest. *J Stat Softw.* 59(9).
- Halfwerk W, Slabbekoorn H. 2009. A behavioural mechanism explaining noise-dependent frequency use in urban birdsong. *Anim Behav.* 78(6):1301–1307. doi:10.1016/j.anbehav.2009.09.015.
- Halfwerk W, Slabbekoorn H. 2015. Pollution going multimodal: the complex impact of the human-altered sensory environment on animal perception and performance. *Biol Lett.* 11(4):20141051. doi:10.1098/rsbl.2014.1051.
- Hamilton WJ. 1962. Evidence concerning the Function of Nocturnal Call Notes of Migratory Birds. *Condor.* 64(5):390–401. doi:10.2307/1365547.
- Haralick RM, Sternberg SR, Zhuang X. 1987. Image analysis using mathematical morphology. *IEEE Trans Pattern Anal Mach Intell.* 9(4):532–550.
- Harding HR, Gordon TAC, Eastcott E, Simpson SD, Radford AN. 2019. Causes and consequences of intraspecific variation in animal responses to anthropogenic noise. *Behav Ecol.*(July). doi:10.1093/beheco/arz114.
- Harding HR, Gordon TAC, Hsuan RE, Mackaness ACE, Radford AN, Simpson SD. 2018. Fish in habitats with higher motorboat disturbance show reduced sensitivity to motorboat noise. *Biol Lett.* 14(10):20180441. doi:10.1098/rsbl.2018.0441.
- Hartman KL, Visser F, Hendriks AJE. 2008. Social structure of Risso's dolphins (*Grampus griseus*) at the Azores: a stratified community based on highly associated social units. *Can J Zool.* 86(4):294–306. doi:10.1139/z07-138.
- Haver SM, Klinck H, Nieukirk SL, Matsumoto H, Dziak RP, Miksis-Olds JL. 2017. The not-so-silent world: Measuring Arctic, Equatorial, and Antarctic soundscapes in the Atlantic Ocean. *Deep Res Part I Oceanogr Res Pap.* 122:95–104. doi:10.1016/j.dsr.2017.03.002.
- Hawkins AD, Pembroke AE, Popper AN. 2014a. Information gaps in understanding the effects of noise on fishes and invertebrates. *Rev Fish Biol Fish.* 25(1):39–64. doi:10.1007/s11160-014-9369-3.
- Hawkins AD, Roberts L, Cheesman S. 2014b. Responses of free-living coastal pelagic fish to impulsive sounds. *J Acoust Soc Am.* 135(5):3101–3116.
- Heiler J, Elwen SH, Kriesell HJ, Gridley T. 2016. Changes in bottlenose dolphin whistle parameters related to vessel presence, surface behaviour and group composition. *Anim Behav.* 117:167–177. doi:10.1016/j.anbehav.2016.04.014.
- Herbert-Read JE, Romanczuk P, Krause S, Strömbom D, Couillaud P, Domenici P, Kurvers RHJM, Marras S, Steffensen JF, Wilson ADM, et al. 2016. Proto-Cooperation: Group hunting sailfish improve hunting success by alternating attacks on

Bibliography

- grouping prey. *Proc R Soc B Biol Sci.* 283(1842). doi:10.1098/rspb.2016.1671.
- Herrera-Montes MI. 2018. Protected Area Zoning as a Strategy to Preserve Natural Soundscapes, Reduce Anthropogenic Noise Intrusion, and Conserve Biodiversity. *Trop Conserv Sci.* 11:194008291880434. doi:10.1177/1940082918804344.
- Herrera-Montes MI, Aide TM. 2011. Impacts of traffic noise on anuran and bird communities. *Urban Ecosyst.* 14(3):415–427. doi:10.1007/s11252-011-0158-7.
- Heupel MR, Simpfendorfer CA, Hueter RE. 2003. Running before the storm: Blacktip sharks respond to falling barometric pressure associated with Tropical Storm Gabrielle. *J Fish Biol.* 63(5):1357–1363. doi:10.1046/j.1095-8649.2003.00250.x.
- Hildebrand JA. 2009. Anthropogenic and natural sources of ambient noise in the ocean. *Mar Ecol Prog Ser.* 395:5–20. doi:10.3354/meps08353.
- Holt MM, Noren DP, Dunkin RC, Williams TM. 2015. Vocal performance affects metabolic rate in dolphins: implications for animals communicating in noisy environments. *J Exp Biol.* 218(11):1647–1654. doi:10.1242/jeb.122424.
- Hubert J, Campbell J, van der Beek JG, den Haan MF, Verhave R, Verkade LS, Slabbekoorn H. 2018. Effects of broadband sound exposure on the interaction between foraging crab and shrimp – A field study. *Environ Pollut.* 243:1923–1929. doi:10.1016/j.envpol.2018.09.076.
- Isojunno S, Sadykova D, DeRuiter SL, Curé C, Visser F, Thomas L, Miller PJO, Harris CM. 2017. Individual, ecological, and anthropogenic influences on activity budgets of long-finned pilot whales. *Ecosphere.* 8(12). doi:10.1002/ecs2.2044.
- Janik VM. 2000. Source levels and the active space of bottlenose dolphin (*Tursiops truncatus*) whistles in the Moray Firth, Scotland. *J Comp Physiol A.* 186:673–680.
- Janik VM, Slater PJB. 1998. Context-specific use suggests that bottlenose dolphin signature whistles are cohesion calls. *Anim Behav.* 56:829–838.
- Jensen FH, Beedholm K, Wahlberg M, Bejder L, Madsen PT. 2012. Estimated communication range and energetic cost of bottlenose dolphin whistles in a tropical habitat. *J Acoust Soc Am.* 131(1):582–592. doi:10.1121/1.3662067.
- Jensen FH, Bejder L, Wahlberg M, Aguilar de Soto N, Johnson MP, Madsen PT. 2009. Vessel noise effects on delphinid communication. *Mar Ecol Prog Ser.* 395:161–175. doi:10.3354/meps08204.
- Jensen FH, Marrero Pérez J, Johnson MP, Aguilar de Soto N, Madsen PT. 2011. Calling under pressure: short-finned pilot whales make social calls during deep foraging dives. *Proc Biol Sci.* 278(1721):3017–3025. doi:10.1098/rspb.2010.2604.
- Johnson MP, Tyack PL. 2003. A Digital Acoustic Recording Tag for Measuring the Response of Wild Marine Mammals to Sound. *IEEE J Ocean Eng.* 28(1):3–12.

Bibliography

- de Jong K, Amorim MCP, Fonseca PJ, Fox CJ, Heubel KU. 2018. Noise can affect acoustic communication and subsequent spawning success in fish. *Environ Pollut.* 237:814–823. doi:10.1016/j.envpol.2017.11.003.
- Kaartvedt S, Rostad A, Aksnes DL. 2017. Changing weather causes behavioral responses in the lower mesopelagic. *Mar Ecol Prog Ser.* 574:259–263.
- Kamil AC, Roitblat HL. 1985. The ecology of foraging behavior: implications for animal learning and memory. *Annu Rev Psychol.* 36(141–69).
- Karp DS, Root TL. 2009. Sound the stressor: How Hoatzins (*Opisthocomus hoazin*) react to ecotourist conversation. *Biodivers Conserv.* 18(14):3733–3742. doi:10.1007/s10531-009-9675-6.
- Kastelein RA, van den Belt I, Helder-Hoek L, Gransier R, Johansson T. 2015. Behavioral responses of a harbor porpoise (*Phocoena phocoena*) to 25-kHz FM sonar signals. *Aquat Mamm.* 41(3):311–326. doi:10.1578/AM.41.3.2015.311.
- Kastelein RA, Gransier R, Hoek L, Olthuis J. 2012. Temporary threshold shifts and recovery in a harbor porpoise (*Phocoena phocoena*) after octave-band noise at 4 kHz. *J Acoust Soc Am.* 132(5):3525–3537. doi:10.1121/1.4757641.
- Kastelein RA, De Haan D, Staal C, Nieuwstraten SH, Verboom WC. 1995a. Entanglement of harbour porpoises (*Phocoena phocoena*) in fishing nets. In: Nachtigall PE, Lien J, Au WWL, Read AJ, editors. Harbour porpoises, laboratory studies to reduce bycatch. Woerden, the Netherlands: De Spil. p. 91–156.
- Kastelein RA, Helder-Hoek L, Van de Voorde S. 2017. Hearing thresholds of a male and a female harbor porpoise (*Phocoena phocoena*). *J Acoust Soc Am.* 142(2):1006. doi:10.1121/1.4997907.
- Kastelein RA, Hoek L, Gransier R, de Jong CAF. 2013. Hearing thresholds of a harbor porpoise (*Phocoena phocoena*) for playbacks of multiple pile driving strike sounds. *J Acoust Soc Am.* 134(3):2302–2306. doi:10.1121/1.4817842.
- Kastelein RA, Hoek L, de Jong CAF, Wensveen PJ. 2010. The effect of signal duration on the underwater detection thresholds of a harbor porpoise (*Phocoena phocoena*) for single frequency-modulated tonal signals between 0.25 and 160 kHz. *J Acoust Soc Am.* 128(5):3211–3222. doi:10.1121/1.3493435.
- Kastelein RA, Huijser LAE, Cornelisse S, Helder-Hoek L, Jennings N, de Jong CAF. 2019. Effect of Pile-Driving Playback Sound Level on Fish-Catching Efficiency in Harbor Porpoises (*Phocoena phocoena*). *Aquat Mamm.* 45(4):398–410. doi:10.1578/am.45.4.2019.398.
- Kastelein RA, Nieuwstraten SH, Verboom WC. 1995b. Echolocation signals of harbour porpoises (*Phocoena phocoena*) in light and complete darkness. Harb Porpoises-laboratory Stud to reduce bycatch.:55–67.

Bibliography

- Kastelein RA, Schop J, Gransier R, Hoek L. 2014. Frequency of greatest temporary hearing threshold shift in harbor porpoises (*Phocoena phocoena*) depends on the noise level. *J Acoust Soc Am*. 136(3):1410–1418. doi:10.1121/1.4892794.
- Kastelein RA, Schop J, Hoek L, Covi J. 2015. Hearing thresholds of a harbor porpoise (*Phocoena phocoena*) for narrow-band sweeps. *J Acoust Soc Am*. 138(4):2508–2512. doi:10.1121/1.4932024.
- Kastelein RA, van der Sijs SJ, Staal C, Nieuwstraten SH. 1997. Blubber thickness in harbour porpoises (*Phocoena phocoena*). In: Read AJ, Wiepkema PR, Nachtigall PE, editors. *The Biology of the Harbour Porpoise*. De Spil Publishers. p. 179–199.
- Kastelein RA, Verboom WC, Jennings N, de Haan D. 2008. Behavioral avoidance threshold level of a harbor porpoise (*Phocoena phocoena*) for a continuous 50 kHz pure tone. *J Acoust Soc Am*. 123(4):1858–1861. doi:10.1121/1.2874557.
- Kastelein RA, Verboom WC, Jennings N, de Haan D, van der Heul S. 2008. The influence of 70 and 120 kHz tonal signals on the behavior of harbor porpoises (*Phocoena phocoena*) in a floating pen. *Mar Environ Res*. 66(3):319–326. doi:10.1016/j.marenvres.2008.05.005.
- Kasumyan AO. 2008. Sounds and sound production in fishes. *J Ichthyol*. 48(11):981–1030. doi:10.1134/S0032945208110039.
- Kern JM, Radford AN. 2016. Anthropogenic noise disrupts use of vocal information about predation risk. *Env Pollut*. 218:988–995. doi:10.1016/j.envpol.2016.08.049.
- Kok ACM, Engelberts JP, Kastelein RA, Helder-Hoek L, Van de Voorde S, Visser F, Slabbekoorn H. 2018. Spatial avoidance to experimental increase of intermittent and continuous sound in two captive harbour porpoises. *Environ Pollut*. 233:1024–1036. doi:10.1016/j.envpol.2017.10.001.
- Kok ACM, Engelberts JP, Visser F, Slabbekoorn H. 2016. Spatial behavior, swimming speed and surfacing rate of two captive harbor porpoises in ambient sound control conditions. *Proc Meet Acoust*. 27:010037. doi:10.1121/2.0000346.
- Kondo N, Watanabe S. 2009. Contact calls: Information and social function. *Jpn Psychol Res*. 51(3):197–208. doi:10.1111/j.1468-5884.2009.00399.x.
- Kunc HP, McLaughlin KE, Schmidt R. 2016. Aquatic noise pollution: implications for individuals, populations, and ecosystems. *Proc Biol Sci*. 283(1836). doi:10.1098/rspb.2016.0839.
- Ladich F, Winkler H. 2017. Acoustic communication in terrestrial and aquatic vertebrates. *J Exp Biol*. 220(Pt 13):2306–2317. doi:10.1242/jeb.132944.
- Lagardère JP, Bégout ML, Lafaye JY, Villotte JP. 1994. Influence of wind-produced noise on orientation in the sole (*Solea solea*). *Can J Fish Aquat Sci*. 51(6):1258–1264.

Bibliography

- Langård L, Øvredal JT, Johannessen A, Nøttestad L, Skaret G, Fernö A, Wahlberg M. 2008. Sound Production in Pre-Spawning Herring, Cod and Haddock in a Naturally Enclosed Ecosystem. *Bioacoustics*. 17(1–3):38–40. doi:10.1080/09524622.2008.9753756.
- Langridge K V. 2009. Cuttlefish use startle displays, but not against large predators. *Anim Behav*. 77(4):847–856. doi:10.1016/j.anbehav.2008.11.023.
- Lawrence JM, Armstrong E, Gordon J, Lusseau SM, Fernandes PG. 2016. Passive and active, predator and prey: using acoustics to study interactions between cetaceans and forage fish. *ICES J Mar Sci J du Cons*. 73(8):2075–2084. doi:10.1093/icesjms/fsw013.
- Lawson GL, Barange M, Fréon P. 2001. Species identification of pelagic fish schools on the South African continental shelf using acoustic descriptors and ancillary information. *ICES J Mar Sci*. 58(1):275–287. doi:10.1006/jmsc.2000.1009.
- Lehtonen J, Jaatinen K. 2016. Safety in numbers: the dilution effect and other drivers of group life in the face of danger. *Behav Ecol Sociobiol*. 70:449–458. doi:10.1007/s00265-016-2075-5.
- Leopold MF. 2015. Eat and be eaten: Porpoise diet studies. Wageningen University.
- Lindeboom HJ, Kouwenhoven HJ, Bergman MJN, Bouma S, Brasseur S, Daan R, Fijn RC, De Haan D, Dirksen S, Van Hal R, et al. 2011. Short-term ecological effects of an offshore wind farm in the Dutch coastal zone; A compilation. *Environ Res Lett*. 6(3). doi:10.1088/1748-9326/6/3/035101.
- Lockyer C, Desportes G, Hansen K, Labberté S, Siebert U. 2003. Monitoring growth and energy utilisation of the harbour porpoise (*Phocoena phocoena*) in human care. *NAMMCO Sci Publ*. 5:107–120.
- Løkkeborg S, Ona E, Vold A, Salthaug A. 2012. Sounds from seismic air guns: gear- and species-specific effects on catch rates and fish distribution. *Can J Fish Aquat Sci*. 69(8):1278–1291. doi:10.1139/f2012-059.
- Lorenz K, Tinbergen N. 1939. Taxis und Instinkthandlung in der Eirrollbewegung der Graugans. 1. *Z Tierpsychol*. 2(1–3):1–29.
- Lowry H, Lill A, Wong BBM. 2013. Behavioural responses of wildlife to urban environments. *Biol Rev*. 88(3):537–549. doi:10.1111/brv.12012.
- Lucke K. 2015. Measurement of Underwater Sound at the GEMINI Windpark Site. Unpublished Report, Centre for Marine Science and Technology, Curtin University, Perth, Australia. Pp 53.
- Luo J, Siemers BM, Koselj K. 2015. How anthropogenic noise affects foraging. *Glob Chang Biol*. 21(9):3278–3289. doi:10.1111/gcb.12997.

Bibliography

- Lurton X. 2002. An Introduction to Underwater Acoustics: Principles and applications. New York: Springer.
- Luther D, Gentry K. 2013. Sources of background noise and their influence on vertebrate acoustic communication. *Behaviour*. 150(9–10):1045–1068. doi:10.1163/1568539X-00003054.
- Madin EMP, Dill LM, Ridlon AD, Heithaus MR, Warner RR. 2016. Human activities change marine ecosystems by altering predation risk. *Glob Chang Biol*. 22(1):44–60. doi:10.1111/gcb.13083.
- Magnhagen C, Forsgren E. 1991. Behavioural responses to different types of predators by sand goby *Pomatoschistus minutus* : an experimental study. *Mar Ecol Prog Ser*. 70:11–16.
- Malavasi S, Georgalas V, Lugli M, Torricelli P, Mainardi D. 2004. Differences in the pattern of antipredator behaviour between hatchery-reared and wild European sea bass juveniles. *J Fish Biol*. 65(SUPPL. A):143–155. doi:10.1111/j.1095-8649.2004.00545.x.
- Mariene Strategie voor het Nederlandse deel van de Noordzee 2012-2020, Deel 1. 2012. Ministerie van Infrastructuur en Milieu.
- Marler P. 2004. Bird calls: a cornucopia for communication. In: Marler P, Slabbekoorn H, editors. *Nature's music, the science of birdsong*. London: Elsevier Academic Press. p. 132–177.
- Marrero Pérez J, Jensen FH, Rojano-Doñate L, Aguilar de Soto N. 2017. Different modes of acoustic communication in deep-diving short-finned pilot whales (*Globicephala macrorhynchus*). *Mar Mammal Sci*. 33(1):59–79. doi:10.1111/mms.12344.
- Marsh HW, Schulkin M. 1962. Shallow-water transmission. *J Acoust Soc Am*. 34:863–864.
- McCarthy E, Moretti D, Thomas L, DiMarzio N, Morrissey R, Jarvis S, Ward J, Izzi A, Dilley A. 2011. Changes in spatial and temporal distribution and vocal behavior of Blainville's beaked whales (*Mesoplodon densirostris*) during multiship exercises with mid-frequency sonar. *Mar Mammal Sci*. 27(3):206–226. doi:10.1111/j.1748-7692.2010.00457.x.
- McCauley RD, Day RD, Swadlow KM, Fitzgibbon QP, Watson RA, Semmens JM. 2017. Widely used marine seismic survey air gun operations negatively impact zooplankton. *Nat Ecol Evol*. 1(7):1–8. doi:10.1038/s41559-017-0195.
- McClure CJ, Ware HE, Carlisle J, Kaltenecker G, Barber JR. 2013. An experimental investigation into the effects of traffic noise on distributions of birds: avoiding the phantom road. *Proc Biol Sci*. 280(1773):20132290. doi:10.1098/rspb.2013.2290.
- McClure CJW, Ware HE, Carlisle JD, Barber JR. 2017. Noise from a phantom road ex-

Bibliography

- periment alters the age structure of a community of migrating birds. *Anim Conserv.* 20(2):164–172. doi:10.1111/acv.12302.
- McCormick MI, Allan BJM, Harding HR, Simpson SD. 2018. Boat noise impacts risk assessment in a coral reef fish but effects depend on engine type. *Sci Rep.* 8(3847):1–11. doi:10.1038/s41598-018-22104-3.
- McDonald MA, Hildebrand JA, Wiggins SM. 2006. Increases in deep ocean ambient noise in the Northeast Pacific west of San Nicolas Island, California. *J Acoust Soc Am.* 120(2):711–718. doi:10.1121/1.2216565.
- McKenna MF, Ross D, Wiggins SM, Hildebrand JA. 2012. Underwater radiated noise from modern commercial ships. *J Acoust Soc Am.* 131(1):92–103. doi:10.1121/1.3664100.
- McLellan BN, Shackleton DM. 1988. Grizzly bears and resource-extraction industries: Effects of roads on behavior, habitat use and demography. *J Appl Ecol.* 25(2):451–460. doi:10.2307/2403836.
- Mercado III E, Frazer LN. 1999. Environmental constraints on sound transmission by humpback whales. *J Acoust Soc Am.* 106(5):3004–3016.
- Merchant ND, Fristrup KM, Johnson MP, Tyack PL, Witt MJ, Blondel P, Parks SE. 2015. Measuring acoustic habitats. *Methods Ecol Evol.* 6(3):257–265. doi:10.1111/2041-210X.12330.
- Miksis-Olds JL, Nichols SM. 2016. Is low frequency ocean sound increasing globally? *J Acoust Soc Am.* 139(1):501–511. doi:10.1121/1.4938237.
- Miller PJO. 2006. Diversity in sound pressure levels and estimated active space of resident killer whale vocalizations. *J Comp Physiol A Neuroethol Sensory, Neural, Behav Physiol.* 192(5):449–459. doi:10.1007/s00359-005-0085-2.
- Miller PJO, Antunes RN, Wensveen PJ, Samarra FI, Alves AC, Tyack PL, Kvadsheim PH, Kleivane L, Lam F-PA, Ainslie MA, et al. 2014. Dose-response relationships for the onset of avoidance of sonar by free-ranging killer whales. *J Acoust Soc Am.* 135(2):975–993. doi:10.1121/1.4861346.
- Miller PJO, Kvadsheim PH, Lam F-PA, Wensveen PJ, Antunes RN, Alves AC, Visser F, Kleivane L, Tyack PL, Sivle LD. 2012. The Severity of behavioral changes observed during experimental exposures of killer (*Orcinus orca*), long-finned Pilot (*Globicephala melas*), and sperm (*Physeter macrocephalus*) whales to naval sonar. *Aquat Mamm.* 38(4):362–401. doi:10.1578/AM.38.4.2012.362.
- Møhl B, Wahlberg M, Madsen PT, Miller LA, Surlykke A. 2002. Sperm whale clicks: Directionality and source level revisited. *J Acoust Soc Am.* 107(1):638–648. doi:10.1121/1.428329.
- Mooney TA, Samson JE, Schlunk AD, Zacarias S. 2016. Loudness-dependent behavio-

Bibliography

- ral responses and habituation to sound by the longfin squid (*Doryteuthis pealeii*). J Comp Physiol A. 202(7):489–501. doi:10.1007/s00359-016-1092-1.
- Moore BCJ. 2013. An Introduction to the Psychology of Hearing. Sixth. Leiden, the Netherlands: Brill.
- Morley EL, Jones G, Radford AN. 2014. The importance of invertebrates when considering the impacts of anthropogenic noise. Proc Biol Sci. 281(1776):20132683. doi:10.1098/rspb.2013.2683.
- Morris-Drake A, Kern JM, Radford AN. 2016. Cross-modal impacts of anthropogenic noise on information use. Curr Biol. 26(20):R911–R912. doi:10.1016/j.cub.2016.08.064.
- Mumm CAS, Urrutia MC, Knörnschild M. 2014. Vocal individuality in cohesion calls of giant otters, *Pteronura brasiliensis*. Anim Behav. 88:243–252. doi:10.1016/j.anbehav.2013.12.005.
- Nedelec SL, Mills SC, Lecchini D, Nedelec B, Simpson SD, Radford AN. 2016. Repeated exposure to noise increases tolerance in a coral reef fish. Env Pollut. 216:428–436. doi:10.1016/j.envpol.2016.05.058.
- Nelson DR, Johnson RH. 1972. Acoustic attraction of pacific reef sharks: Effect of pulse intermittency and variability. Comp Biochem Physiol -- Part A Physiol. 42(1). doi:10.1016/0300-9629(72)90370-2.
- Neo YY, Hubert J, Bolle L, Winter H V., Ten Cate C, Slabbekoorn H. 2016. Sound exposure changes European seabass behaviour in a large outdoor floating pen: Effects of temporal structure and a ramp-up procedure. Environ Pollut. 214:26–34. doi:10.1016/j.envpol.2016.03.075.
- Neo YY, Hubert J, Bolle LJ, Winter H V., Slabbekoorn H. 2018. European seabass respond more strongly to noise exposure at night and habituate over repeated trials of sound exposure. Environ Pollut. 239(August):367–374. doi:10.1016/j.envpol.2018.04.018.
- Neo YY, Parie L, Bakker F, Snelderwaard P, Tudorache C, Schaaf M, Slabbekoorn H. 2015a. Behavioral changes in response to sound exposure and no spatial avoidance of noisy conditions in captive zebrafish. Front Behav Neurosci. 9:28. doi:10.3389/fnbeh.2015.00028.
- Neo YY, Seitz J, Kastelein RA, Winter H V., ten Cate C, Slabbekoorn H. 2014. Temporal structure of sound affects behavioural recovery from noise impact in European seabass. Biol Conserv. 178:65–73. doi:10.1016/j.biocon.2014.07.012.
- Neo YY, Ufkes E, Kastelein RA, Winter H V., Ten Cate C, Slabbekoorn H. 2015b. Impulsive sounds change European seabass swimming patterns: Influence of pulse repetition interval. Mar Pollut Bull. 97(1–2):111–117. doi:10.1016/j.marpol-

bul.2015.06.027.

- Nichols TA, Anderson TW, Širović A. 2015. Intermittent noise induces physiological stress in a coastal marine fish. *PLoS One*. 10(9):1–13. doi:10.1371/journal.pone.0139157.
- Nielsen TP, Wahlberg M, Heikkilä S, Jensen M, Sabinsky P, Dabelsteen T. 2012. Swimming patterns of wild harbour porpoises *Phocoena phocoena* show detection and avoidance of gillnets at very long ranges. *Mar Ecol Prog Ser*. 453:241–248. doi:10.3354/meps09630.
- Nogueira SSC, Pedroza JP, Nogueira-Filho SLG, Tokumaru RS. 2012. The Function of Click Call Emission in Capybaras (*Hydrochoerus hydrochaeris*). *Ethology*. 118(10):1001–1009. doi:10.1111/eth.12001.
- Ottensmeyer CA, Whitehead H. 2003. Behavioural evidence for social units in long-finned pilot whales. *Can J Zool*. 81(8):1327–1338. doi:10.1139/z03-127.
- Palmer C, Baird RW, Webster DL, Edwards AC, Patterson R, Withers A, Withers E, Groom R, Woinarski JCZ. 2017. A preliminary study of the movement patterns of false killer whales (*Pseudorca crassidens*) in coastal and pelagic waters of the Northern Territory, Australia. *Mar Freshw Res*. 68:1726–1733. doi:10.1071/MF16296.
- Parks SE, Cusano DA, Stimpert AK, Weinrich MT, Friedlaender AS, Wiley DN. 2014. Evidence for acoustic communication among bottom foraging humpback whales. *Sci Rep*. 4(7508). doi:10.1038/srep07508.
- Parks SE, Johnson MP, Nowacek D, Tyack PL. 2011. Individual right whales call louder in increased environmental noise. *Biol Lett*. 7(1):33–35. doi:10.1098/rsbl.2010.0451.
- Parry GD, Gason A. 2006. The effect of seismic surveys on catch rates of rock lobsters in western Victoria, Australia. *Fish Res*. 79(3):272–284. doi:10.1016/j.fishres.2006.03.023.
- Pasquaretta C, Busia L, Ferrari C, Bogliani G, Reale D, Von Hardenberg A. 2015. Helpers influence on territory use and maintenance in Alpine marmot groups. *Behaviour*. 152:1391–1412.
- Paxton AB, Taylor JC, Nowacek DP, Dale J, Cole E, Voss CM, Peterson CH. 2017. Seismic survey noise disrupted fish use of a temperate reef. *Mar Policy*. 78:68–73. doi:10.1016/j.marpol.2016.12.017.
- PCEU. 2008. DIRECTIVE 2008/56/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive).
- Picciulin M, Sebastianutto L, Codarin A, Farina A, Ferrero EA. 2010. In situ behav-

Bibliography

- itorial responses to boat noise exposure of *Gobius cruentatus* (Gmelin, 1789; fam. Gobiidae) and *Chromis chromis* (Linnaeus, 1758; fam. Pomacentridae) living in a Marine Protected Area. *J Exp Mar Bio Ecol.* 386(1–2):125–132. doi:10.1016/j.jembe.2010.02.012.
- Piza P, Sandoval L. 2016. The differences in transmission properties of two bird calls show relation to their specific functions. *J Acoust Soc Am.* 140(6):4271–4275. doi:10.1121/1.4971418.
- Popper AN. 2012. Fish hearing and sensitivity to acoustic impacts.
- Popper AN, Hastings MC. 2009. The effects of anthropogenic sources of sound on fishes. *J Fish Biol.* 75(3):455–489. doi:10.1111/j.1095-8649.2009.02319.x.
- Purser J, Bruintjes R, Simpson SD, Radford AN. 2016. Condition-dependent physiological and behavioural responses to anthropogenic noise. *Physiol Behav.* 155:157–161. doi:10.1016/j.physbeh.2015.12.010.
- Purser J, Radford AN. 2011. Acoustic Noise Induces Attention Shifts and Reduces Foraging Performance in Three-Spined Sticklebacks (*Gasterosteus aculeatus*). *PLoS One.* 6(2):e17478. doi:10.1371/journal.pone.0017478.
- Radford AN, Kerridge E, Simpson SD. 2014. Acoustic communication in a noisy world: can fish compete with anthropogenic noise? *Behav Ecol.* 25(5):1022–1030. doi:10.1093/beheco/aru029.
- Radford AN, Lebre L, Lecaillon G, Nedelec SL, Simpson SD. 2016. Repeated exposure reduces the response to impulsive noise in European seabass. *Glob Chang Biol.* 22(10):3349–3360. doi:10.1111/gcb.13352.
- Rao TR. 2018. Trophic cascades. *Resonance*.(November):1205–1213.
- Raoux A, Tecchio S, Pezy JP, Lassalle G, Degraer S, Wilhelmsson D, Cachera M, Ernande B, Le Guen C, Haraldsson M, et al. 2017. Benthic and fish aggregation inside an offshore wind farm: Which effects on the trophic web functioning? *Ecol Indic.* 72:33–46. doi:10.1016/j.ecolind.2016.07.037.
- Read J, Jones G, Radford AN. 2014. Fitness costs as well as benefits are important when considering responses to anthropogenic noise. *Behav Ecol.* 25(1):4–7. doi:10.1093/beheco/art102.
- Reid DG, Simmonds EJ. 1993. Image analysis techniques for the study of fish school structure from acoustic survey data. *Can J Fish Aquat Sci.* 50(5):886–893.
- Rendall D, Cheney DL, Seyfarth RM. 2000. Proximate factors mediating “contact” calls in adult female baboons (*Papio cynocephalus ursinus*) and their infants. *J Comp Psychol.* 114(1):36–46. doi:10.1037/0735-7036.114.1.36.
- Rendell LE, Matthews JN, Gill A, Gordon JCD, Macdonald DW. 1999. Quantitative

Bibliography

- analysis of tonal calls from five odontocete species, examining interspecific and intraspecific variation. *J Zool L.* 249:403–410. doi:10.1017/S0952836999009875.
- Richardson WJ, Würsig B. 1997. Influences of man-made noise and other human actions on cetacean behaviour. *Mar Freshw Behav Physiol.* 29(1–4):183–209. doi:10.1080/10236249709379006.
- Rieucan G, Boswell KM, De Robertis A, Macaulay GJ, Handegard NO. 2014. Experimental evidence of threat-sensitive collective avoidance responses in a large wild-caught herring school. *PLoS One.* 9(1):27–30. doi:10.1371/journal.pone.0086726.
- Roos MM, Wu GM, Miller PJO. 2016. The significance of respiration timing in the energetics estimates of free-ranging killer whales (*Orcinus orca*). *J Exp Biol.* 219(Pt 13):2066–2077. doi:10.1242/jeb.137513.
- Rosa P, Koper N. 2018. Integrating multiple disciplines to understand effects of anthropogenic noise on animal communication: Ecosphere. 9(2). doi:10.1002/ecs2.2127.
- Ryan MJ, Brenowitz EA. 1985. The role of body size, phylogeny, and ambient noise in the evolution of bird song. *Am Nat.* 126:87–100.
- Ryder TB, Parker PG, Blake JG, Loiselle BA. 2009. It takes two to tango: Reproductive skew and social correlates of male mating success in a lek-breeding bird. *Proc R Soc B Biol Sci.* 276(1666):2377–2384. doi:10.1098/rspb.2009.0208.
- Sarà G, Dean JM, D'Amato D, Buscaino G, Oliveri A, Genovese S, Ferro S, Buffa G, Martire M Lo, Mazzola S. 2007. Effect of boat noise on the behaviour of bluefin tuna *Thunnus thynnus* in the Mediterranean Sea. *Mar Ecol Prog Ser.* 331:243–253.
- Schakner ZA, Blumstein DT. 2013. Behavioral biology of marine mammal deterrents: A review and prospectus. *Biol Conserv.* 167:380–389. doi:10.1016/j.biocon.2013.08.024.
- Schaub A, Ostwald J, Siemers BM. 2008. Foraging bats avoid noise. *J Exp Biol.* 211(18):3174–3180. doi:10.1242/jeb.037283.
- Schecklman S, Laws N, Zurk LM, Siderius M. 2015. A computational method to predict and study underwater noise due to pile driving. *J Acoust Soc Am.* 138(1):258–266. doi:10.1121/1.4922333.
- Scheidat M, Tougaard J, Brasseur S, Carstensen J, van Polanen Petel T, Teilmann J, Reijnders P. 2011. Harbour porpoises (*Phocoena phocoena*) and wind farms: a case study in the Dutch North Sea. *Environ Res Lett.* 6(2):25102. doi:10.1088/1748-9326/6/2/025102.
- Scheidat M, Verdaat H, Aarts G. 2012. Using aerial surveys to estimate density and distribution of harbour porpoises in Dutch waters. *J Sea Res.* 69:1–7. doi:10.1016/j.seares.2011.12.004.

Bibliography

- Sebastianutto L, Picciulin M, Costantini M, Ferrero EA. 2011. How boat noise affects an ecologically crucial behaviour: the case of territoriality in *Gobius cruentatus* (Gobiidae). *Environ Biol Fishes*. 92(2):207–215. doi:10.1007/s10641-011-9834-y.
- Secor DH, Zhang F, O'Brien MHP, Li M. 2019. Ocean destratification and fish evacuation caused by a Mid-Atlantic tropical storm. *ICES J Mar Sci*. 76(2):573–584. doi:10.1093/icesjms/fsx241.
- Sertlek HÖ. 2016. *Aria of the Dutch North Sea*. Ainslie MA, Slabbekoorn H, editors. [Leiden]: Leiden University.
- Sertlek HÖ, Slabbekoorn H, ten Cate C, Ainslie MA. 2019. Source specific sound mapping: Spatial, temporal and spectral distribution of sound in the Dutch North Sea. *Environ Pollut*. 247:1143–1157. doi:10.1016/j.envpol.2019.01.119.
- Shafiei Sabet S, Van Dooren D, Slabbekoorn H. 2016. Son et lumière: Sound and light effects on spatial distribution and swimming behavior in captive zebrafish. *Environ Pollut*. 212:480–488. doi:10.1016/j.envpol.2016.02.046.
- Shafiei Sabet S, Neo YY, Slabbekoorn H. 2015. The effect of temporal variation in sound exposure on swimming and foraging behaviour of captive zebrafish. *Anim Behav*. 107:49–60. doi:10.1016/j.anbehav.2015.05.022.
- Shannon G, McKenna MF, Angeloni LM, Crooks KR, Fristrup KM, Brown E, Warner KA, Nelson MD, White C, Briggs J, et al. 2016. A synthesis of two decades of research documenting the effects of noise on wildlife. *Biol Rev Camb Philos Soc*. 91(4):982–1005. doi:10.1111/brv.12207.
- Siemers BM, Schaub A. 2011. Hunting at the highway: traffic noise reduces foraging efficiency in acoustic predators. *Proc Biol Sci*. 278(1712):1646–1652. doi:10.1098/rspb.2010.2262.
- Simard Y, Roy N, Gervaise C, Giard S. 2016. Analysis and modeling of 255 source levels of merchant ships from an acoustic observatory along St. Lawrence Seaway. *J Acoust Soc Am*. 140(3):2002. doi:10.1121/1.4962557.
- Simpson SD, Purser J, Radford AN. 2015. Anthropogenic noise compromises antipredator behaviour in European eels. *Glob Chang Biol*. 21(2):586–593. doi:10.1111/gcb.12685.
- Simpson SD, Radford AN, Nedelec S, Ferarri MCO, Chivers DP, McCormick MI, Meehan MG. 2016. Small-Boat Noise Impacts Natural Settlement Behavior of Coral Reef Fish Larvae. *Adv Exp Med Biol*. 875:1041–1048. doi:10.1007/978-1-4939-2981-8_129.
- Simpson SD, Radford AN, Nedelec SL, Ferrari MCO, Chivers DP, McCormick MI, Meehan MG. 2016. Anthropogenic noise increases fish mortality by predation. *Nat Commun*. 7:1–7. doi:10.1038/ncomms10544.

Bibliography

- Sivle LD, Kvadsheim PH, Fahlman A, Lam F-PA, Tyack PL, Miller PJO. 2012. Changes in dive behavior during naval sonar exposure in killer whales, long-finned pilot whales, and sperm whales. *Front Physiol.* 3:400. doi:10.3389/fphys.2012.00400.
- Skalski JR, Pearson WH, Malme CI. 1992. Effects of sounds from a geophysical survey device on behaviour of captive rockfish (*Sebastes spp.*). *Can J Fish Aquat Sci.* 49:1357–1365.
- Slabbekoorn H. 2013. Songs of the city: Noise-dependent spectral plasticity in the acoustic phenotype of urban birds. *Anim Behav.* 85:1089–1099.
- Slabbekoorn H, Bouton N, van Opzeeland I, Coers A, ten Cate C, Popper AN. 2010. A noisy spring: the impact of globally rising underwater sound levels on fish. *Trends Ecol Evol.* 25(7):419–427. doi:10.1016/j.tree.2010.04.005.
- Slabbekoorn H, Dalen J, de Haan D, Winter H V., Radford CA, Ainslie MA, Heaney KD, van Kooten T, Thomas L, Harwood J. 2019. Population-level consequences of seismic surveys on fishes: An interdisciplinary challenge. *Fish Fish.*(March):653–685. doi:10.1111/faf.12367.
- Slabbekoorn H, Dooling RJ, Popper AN. 2018. Man-made sounds and animals. In: Slabbekoorn H, Dooling RJ, Popper AN, Fay RR, editors. *Effects of Anthropogenic noise on animals*. 1st ed. New York: Springer Science + Business Media New York.
- Slotte A, Hansen K, Dalen J, Ona E. 2004. Acoustic mapping of pelagic fish distribution and abundance in relation to a seismic shooting area off the Norwegian west coast. *Fish Res.* 67(2):143–150. doi:10.1016/j.fishres.2003.09.046.
- Snijders L, Naguib M. 2017. Communication in Animal Social Networks. (*Advances in the Study of Behavior*). p. 297–359.
- Snijders L, van Oers K, Naguib M. 2017. Sex-specific responses to territorial intrusions in a communication network: Evidence from radio-tagged great tits. *Ecol Evol.* 7:918–927.
- Sörqvist P, Nörtl A, Halin N. 2012. Working memory capacity modulates habituation rate: Evidence from a cross-modal auditory distraction paradigm. *Psychon Bull Rev.* 19(2):245–250. doi:10.3758/s13423-011-0203-9.
- Southall BL, Benoit-Bird KJ, Moline MA, Moretti D. 2019. Quantifying deep-sea predator–prey dynamics: Implications of biological heterogeneity for beaked whale conservation. *J Appl Ecol.*(November 2018):1–10. doi:10.1111/1365-2664.13334.
- Southall BL, Bowles AE, Ellison WT, Finneran JJ, Gentry RL, Jr. CRG, Kastak D, Ketten DR, Miller JH, Nachtigall PE, et al. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. *Aquat Mamm.* 33(4):411–521. doi:10.1578/AM.33.4.2007.411.
- Southall BL, Nowacek DP, Miller PJO, Tyack PL. 2016. Experimental field studies

Bibliography

- to measure behavioral responses of cetaceans to sonar. *Endanger Species Res.* 31:293–315. doi:10.3354/esr00764.
- Starfield AM. 1997. A Pragmatic Approach to Modeling for Wildlife Management. *J Wildl Manage.* 61(2):261. doi:10.2307/3802581.
- Taruski AG. 1979. The whistle repertoire of the North Atlantic pilot whale (*Globicephala melaena*) and its relationship to behavior and environment. In: Winn HE, Olla BL, editors. *Behavior of marine mammals*, vol 3. New York. p. 345–368.
- Teilmann J, Tougaard J, Miller LA, Kirketerp T, Hansen K, Brando S. 2006. Reactions of captive harbor porpoises (*Phocoena phocoena*) to pinger-like sounds. *Mar Mammal Sci.* 22(2):240–260. doi:10.1111/j.1748-7692.2006.00031.x.
- Thiebault A, Mullers RHE, Pistorius PA, Tremblay Y. 2014. Local enhancement in a seabird: Reaction distances and foraging consequence of predator aggregations. *Behav Ecol.* 25(6):1302–1310. doi:10.1093/beheco/aru132.
- Thompson PM, Brookes KL, Graham IM, Barton TR, Needham K, Bradbury G, Merchant ND. 2013. Short-term disturbance by a commercial two-dimensional seismic survey does not lead to long-term displacement of harbour porpoises. *Proc R Soc B Biol Sci.* 280(1771):20132001. doi:10.1098/rspb.2013.2001.
- Thomson R, Sporcic M, Foster S, Haddon M, Potter A, Przeslawski R, Knuckey I, Koopman M, Hartog J. 2014. Examining Fisheries Catches and Catch Rates for Potential Effects of Bass Strait Seismic Surveys.
- Tougaard J, Carstensen J, Teilmann J, Skov H, Rasmussen P. 2009. Pile driving zone of responsiveness extends beyond 20 km for harbor porpoises (*Phocoena phocoena* (L.)). *J Acoust Soc Am.* 126(1):11–14. doi:10.1121/1.3132523.
- Trygonis V, Georgakarakos S, Simmonds EJ. 2009. An operational system for automatic school identification on multibeam sonar echoes. *ICES J Mar Sci.* 66(5):935–949. doi:10.1093/icesjms/fsp135.
- Tsuda Y, Kawabe R, Tanaka H, Mitsunaga Y, Hiraishi T, Yamamoto K, Nashimoto K. 2006. Monitoring the spawning behaviour of chum salmon with an acceleration data logger. *Ecol Freshw Fish.* 15(3):264–274. doi:10.1111/j.1600-0633.2006.00147.x.
- Tudorache C, Schaaf MJ, Slabbekoorn H. 2013. Covariation between behaviour and physiology indicators of coping style in zebrafish (*Danio rerio*). *J Endocrinol.* 219(3):251–258. doi:10.1530/JOE-13-0225.
- Turl CW, Fish JF. 1976. *Acoustic source levels of four species of small whales*. San Diego.
- Tyack PL. 2000. Functional aspects of cetacean communication. In: Mann J, Connor RC, Tyack P L, Whitehead H, editors. *Cetacean Societies. Field Studies of Dolphins and Whales*. Chicago and London: The University of Chicago Press. p. 270–307.

Bibliography

- Tyack PL, Zimmer WMX, Moretti D, Southall BL, Claridge DE, Durban JW, Clark CW, D'Amico A, DiMarzio N, Jarvis S, et al. 2011. Beaked whales respond to simulated and actual navy sonar. *PLoS One*. 6(3):e17009. doi:10.1371/journal.pone.0017009.
- Urick RJ. 1983. Principles of underwater sound (third edition). Davis J, editor. Los Altos Hills, USA: Peninsula Publishing.
- Venables WN, Ripley BD. 2002. Modern Applied Statistics with S. Fourth Edition. New York: Springer.
- Villadsgaard A, Wahlberg M, Tougaard J. 2007. Echolocation signals of wild harbour porpoises, *Phocoena phocoena*. *J Exp Biol*. 210(Pt 1):56–64. doi:10.1242/jeb.02618.
- Visser F, Antunes RN, Oudejans MG, Miller PJO, Lam F-PA, Kvadsheim PH, Huisman J, Tyack PL, Mackenzie ML, Aoki K. 2014. The social context of individual foraging behaviour in long-finned pilot whales (*Globicephala melas*). *Behaviour*. 151(10):1453–1477. doi:10.1163/1568539x-00003195.
- Visser F, Curé C, Kvadsheim PH, Lam F-PA, Tyack PL, Miller PJO. 2016. Disturbance-specific social responses in long-finned pilot whales, *Globicephala melas*. *Sci Rep*. 6:28641. doi:10.1038/srep28641.
- Visser F, Kok ACM, Oudejans MG, Scott-Hayward LAS, DeRuiter SL, Alves AC, Antunes RN, Isojunno S, Pierce GJ, Slabbekoorn H, et al. 2017. Vocal foragers and silent crowds: context-dependent vocal variation in Northeast Atlantic long-finned pilot whales. *Behav Ecol Sociobiol*. 71(12):170. doi:10.1007/s00265-017-2397-y.
- Voellmy IK, Purser J, Flynn D, Kennedy P, Simpson SD, Radford AN. 2014a. Acoustic noise reduces foraging success in two sympatric fish species via different mechanisms. *Anim Behav*. 89:191–198. doi:10.1016/j.anbehav.2013.12.029.
- Voellmy IK, Purser J, Simpson SD, Radford AN. 2014b. Increased noise levels have different impacts on the anti-predator behaviour of two sympatric fish species. *PLoS One*. 9(7):e102946. doi:10.1371/journal.pone.0102946.
- Watwood SL, Miller PJO, Johnson MP, Madsen PT, Tyack PL. 2006. Deep-diving foraging behaviour of sperm whales (*Physeter macrocephalus*). *J Anim Ecol*. 75(3):814–825. doi:10.1111/j.1365-2656.2006.01101.x.
- Weber TC, Peña H, Jech JM. 2009. Consecutive acoustic observations of an Atlantic herring school in the Northwest Atlantic. *ICES J Mar Sci*. 66(6):1270–1277. doi:10.1093/icesjms/fsp090.
- Weilgart LS, Whitehead H. 1990. Vocalizations of the North Atlantic pilot whale (*Globicephala melas*) as related to behavioral contexts. *Behav Ecol Sociobiol*. 26:399–402.

Bibliography

- Wensveen PJ. 2016. Detecting, Assessing, and Mitigating the Effects of Naval Sonar on Cetaceans. University of St Andrews.
- Wensveen PJ, von Benda-Beckmann AM, Ainslie MA, Lam F-PA, Kvadsheim PH, Tyack PL, Miller PJO. 2015. How effectively do horizontal and vertical response strategies of long-finned pilot whales reduce sound exposure from naval sonar? *Mar Env Res.* 106:68–81. doi:10.1016/j.marenvres.2015.02.005.
- Wenz GM. 1962. Acoustic ambient noise in the ocean: spectra and sources. *J Acoust Soc Am.* 34(12):1936–1956. doi:10.1121/1.1909155.
- Whitehead H. 1989. Formations of foraging sperm whales (*Physeter macrocephalus*) off the Galápagos Islands. *Can J Zool.* 67(9):2131–2139.
- Whitehead H, Dillon M, Dufault S, Weilgart LS, Wright AJ. 1998. Non-geographically based population structure of South Pacific sperm whales: dialects, fluke markings and genetics. *J Anim Ecol.* 67:253–262.
- Whitehead H, Waters S, Lyrholm T. 1991. Social organization of female sperm whales and their offspring: constant companions and casual acquaintances. *Behav Ecol Sociobiol.* 29(5):385–389. doi:10.1007/BF00165964.
- Wiley RH. 2013. A receiver–signaler equilibrium in the evolution of communication in noise. *Behaviour.* 150:1–37. doi:10.1163/1568539x-00003063.
- Wirsing AJ, Cameron KE, Heithaus MR. 2010. Spatial responses to predators vary with prey escape mode. *Anim Behav.* 79(3):531–537. doi:10.1016/j.anbehav.2009.12.014.
- Wisniewska DM, Johnson MP, Teilmann J, Rojano-Doñate L, Shearer J, Sveegaard S, Miller LA, Siebert U, Madsen PT. 2016. Ultra-High Foraging Rates of Harbor Porpoises Make Them Vulnerable to Anthropogenic Disturbance. *Curr Biol.* 26(11):1441–1446. doi:10.1016/j.cub.2016.03.069.
- Wrege PH, Rowland ED, Thompson BG, Batruch N. 2010. Use of acoustic tools to reveal otherwise cryptic responses of forest elephants to oil exploration. *Conserv Biol.* 24(6):1578–1585. doi:10.1111/j.1523-1739.2010.01559.x.
- Wright AJ, Maar M, Mohn C, Nabe-Nielsen J, Siebert U, Jensen LF, Baagøe HJ, Teilmann J. 2013. Possible causes of a harbour porpoise mass stranding in Danish waters in 2005. *PLoS One.* 8(2):e55553. doi:10.1371/journal.pone.0055553.
- Yao CL, Somero GN. 2014. The impact of ocean warming on marine organisms. *Chinese Sci Bull.* 59(5–6):468–479. doi:10.1007/s11434-014-0113-0.
- Zhang S, Wang J, Liu X, Qu F, Wang Xueshan, Wang Xinrui, Li Y, Sun Y. 2019. Microplastics in the environment: A review of analytical methods, distribution, and biological effects. *TrAC - Trends Anal Chem.* 111:62–72. doi:10.1016/j.trac.2018.12.002.

Bibliography

Zwamborn EMJ, Whitehead H. 2016. Repeated call sequences and behavioural context in long-finned pilot whales off Cape Breton, Nova Scotia, Canada. *Bioacoustics*. 26(2):1–15. doi:10.1080/09524622.2016.1233457.



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Curriculum Vitae

Annebelle Kok was born in 1989 in Leiden, the Netherlands. She attended school at Het Rijnlands Lyceum Oegstgeest from 2001 to 2007, following a bilingual VWO-Gymnasium programme. In her penultimate school year, she followed the pre-university course LAPP-Top, focussing on Comparative Indo-European Linguistics. After school, she obtained her Bachelor's degree in Biology at Leiden University between 2007 and 2010, followed by a Master's degree in Evolution, Biodiversity and Conservation between 2010 and 2013, also at Leiden University.

During her Bachelor, she did an internship with Dr Caroline van Heijningen and Prof Dr Carel ten Cate, setting up a protocol for a habituation/dishabituation paradigm in zebra finches. In the final year of her Bachelor, she also participated in an honours programme focussing on better understanding photosynthesis to optimize solar energy techniques. During her Master, she did two internships, one with Dr Liew Thor-Seng and Prof Dr Menno Schilthuizen, working on shell growth and development in two snail species. Her second internship was with Dr Fleur Visser and Dr Hans Slabbekoorn, where she investigated the relationship between social, vocal and diving behaviour in long-finned pilot whales.

After graduating, she worked as a self-employed scientist from 2013 to 2015, spending the summers of 2013 and 2014 as a marine mammal field scientist and data analyst at Kelp Marine Research. In the summer of 2015, she started her PhD on the effects of noise on predator-prey relationships in a marine ecosystem, which she finished at the end of 2019. During her PhD, she conducted several scientific studies, as well as spending one-third of her time teaching Bachelor and Master students. She received several awards for communicating science through talks or articles. Currently, she is starting a Postdoctoral position at Scripps Institution of Oceanography in La Jolla, United States.

Publications

- Liew, T.-S., **Kok, A. C. M.**, Schilthuizen, M., & Urdy, S. (2014). On growth and form of irregular coiled-shell of a terrestrial snail: *Plectostoma concinnum* (Fulton, 1901) (Mollusca: Caenogastropoda: Diplommatinidae). *PeerJ*, 2, e383. <https://doi.org/10.7717/peerj.383>
- Kok, A. C. M.**, Engelberts, J. P., Visser, F., & Slabbekoorn, H. (2016). Spatial behavior, swimming speed and surfacing rate of two captive harbor porpoises in ambient sound control conditions. *Proceedings of Meetings on Acoustics*, 27, 010037. <https://doi.org/10.1121/2.0000346>
- Visser, F., **Kok, A. C. M.**, Oudejans, M. G., Scott-Hayward, L. A. S., DeRuiter, S. L., Alves, A. C., ... Miller, P. J. O. (2017). Vocal foragers and silent crowds: context-dependent vocal variation in Northeast Atlantic long-finned pilot whales. *Behav Ecol Sociobiol*, 71(12), 170. <https://doi.org/10.1007/s00265-017-2397-y>
- Kok, A. C. M.**, Engelberts, J. P., Kastelein, R. A., Helder-Hoek, L., Van de Voorde, S., Visser, F., & Slabbekoorn, H. (2018). Spatial avoidance to experimental increase of intermittent and continuous sound in two captive harbour porpoises. *Environmental Pollution*, 233, 1024–1036. <https://doi.org/10.1016/j.envpol.2017.10.001>

