

Arne Ludwig
Department of Evolutionary Genetics
Phone +49 30 5168312
Ludwig@izw-berlin.de



Curriculum vitae

1988 – 1993	Study of Animal Breeding and Genetics at the Humboldt-University Berlin (HUB), Germany (Diploma in Animal Production)
1993 – 1996	Ph.D. Candidate awarded by a NaFöG scholarship from the State of Berlin
1993 – 1994	Visiting Ph.D. Student at the University of Witwatersrand Johannesburg, Department of Zoology, South Africa
1994	Visiting researcher at the Department of Molecular Ecology, University of Bremen
1997	Dissertation in Animal Genetics and Breeding Biology
Jan 1997 – Dec 2001	Scientist at the Leibniz-Institute of Freshwater Ecology and Inland Fisheries Berlin, Department of Biology and Ecology of Fishes
Since Jan 2002	Staff scientist at the Leibniz Institute for Zoo and Wildlife Research (IZW), Department of Evolutionary Genetics
Since 2003	Head of the DNA-Service Laboratory at the IZW
Jan 2005	Habilitation in Genetics (<i>Sturgeon as model of genetic research</i>)
May 2005	Appointment in the IUCN Sturgeon Specialist Group
Since Jun 2005	Lecturer for Genetics at the Faculty of Agriculture of the HUB
2006	Founding of the ancient DNA Laboratory (<i>trace lab</i>) at the HUB
2007	Founding member of the Berlin Centre of Genetic Variation and Adaptation
2006	Editorial board member of the Journal of Applied Ichthyology (since 2008 Subject Editor for Genetics)
2007-2008	Editorial Board Member of the Open Journal of Ecology
Oct 2009	Member of the IUCN Red List Assessment Group, Wuhan, China
2009	Award from the Forschungsverbund Berlin e.V. for outstanding scientific publications and transfer of scientific research into public media
2010	Appointment in the Scientific Advisory Board of the Zoo Arche Warder
2010	Certificate of Appreciation from the World Sturgeon Conservation Society for “Outstanding contributions to the studies on the genetics of sturgeon species”
2011	Award from the Forschungsverbund Berlin e.V. for outstanding scientific publications and transfer of scientific research into public media
2012	Editorial board member of Genetics Research International

Lectures at the Humboldt-University Berlin

1991 – 1993	Courses in Population Genetics and Zoology at the Museum of Natural History (Faculty of Natural Sciences I, Institute of Biology)
2000 – 2002	Genetics of Fishes including biodiversity and conservation of endangered Fishes (International Master Studies of Aquatic Sciences)
Since 2005	Lectures in Molecular Animal Breeding I and II (Evolutionary Genetics, Molecular Phylogenetics, Population Genetics)
Since 2005	Molecular Techniques (Laboratory course)
Since 2009	The Art of Scientific Writing and Publishing

Five most important publications

- Pruvost, M., R. Bellone, N. Benecke, E. Sandoval-Castellanos, M. Cieslak, T. Kuznetsova, A. Morales-Muñiz, T. O'Connor, M. Reissmann, M. Hofreiter & A. Ludwig (2011): Genotypes of pre-domestic horses match phenotypes painted in Paleolithic works of cave art. *Proceedings of the National Academy of Sciences USA* 108: 18626-18630.
- **Top 10 PNAS Publications 2011 (www.pnas.org/site/misc/topten2011.shtml)**
- Ludwig, A., M. Pruvost, M. Reissmann, N. Benecke, G. A. Brockmann, P. Castanos, M. Cieslak, S. Lippold, L. Llorente, A.-S. Malaspinas, M. Slatkin, M. Hofreiter (2009): Coat color variation at the beginning of horse domestication. *Science* 324: 485.
- Cieslak M, M Reissmann, M Hofreiter & A Ludwig (2011): Colours of domestication. *Biological Reviews* 86: 885-899.
- Ludwig, A., L. Debus, D. Lieckfeldt, I. Wirgin, N. Benecke, I. Jenneckens, P. Williot, J. R. Waldman & C. Pitra (2002): When the American sea sturgeon swam east. *Nature* 419: 447-448.
- Ludwig A, N M Belfiore, C Pitra, V Svirsky & I Jenneckens (2001): Genome duplication events and functional reduction of ploidy levels in sturgeon (*Acipenser*, *Huso* and *Scaphirhynchus*). *Genetics* 158: 1203-1215.

Selected list of publications

- Ludwig, A., L. Alderson, E. Fandrey, D. Lieckfeldt, T. K. Soederlund & K. Froelich (2013): Tracing the genetic roots of the indigenous White Park Cattle. *Animal Genetics*: doi: 10.1111/age.12026.
- Yasui, S., A. Konno, M. Tanaka, G. Idani, A. Ludwig, D. Lieckfeldt & M. Inoue-Murayama (2013), Personality assessment and its association with genetic factors in captive Asian and African elephants. *Zoo Biology*: doi: 10.1002/zoo.21045.
- Ludwig, A., Pruvost M., R. Bellone, N. Benecke, E. Sandoval-Castellanos, A. Morales-Muñiz, T. O'Connor, M. Reissmann & M. Hofreiter (2012): Reply to Bar-Oz and Lev-Yadun: Horse colors in time and space. *Proceedings of the National Academy of Sciences USA* 109: E1213.
- Reid, C.E., L. Versteegen, A. Ludwig & R. Hermes (2012): Analysis of the European captive Southern white rhinoceros *Ceratotherium simum simum* population using the International Studbook for the African White Rhinoceros (2001–2004) and integrating reproductive health findings. *International Zoo Yearbook* 46: 209-220.
- Ludwig, A., C. Vernesi, D. Lieckfeldt, E. Z. Lattenkamp, A. Wiethölter, W. Lutz (2012): Origin and patterns of genetic diversity of German fallow deer as inferred from mitochondrial DNA. *European Journal of Wildlife Research* 58: 495–501.
- Pruvost, M., M. Reissmann, N. Benecke & A. Ludwig (2012): From genes to phenotypes - evaluation of two methods for the SNP analysis in archaeological remains: pyrosequencing and competitive allele specific PCR KASPar. *Annals of Anatomy* 194: 74-81.
- Pruvost, M., R. Bellone, N. Benecke, E. Sandoval-Castellanos, M. Cieslak, T. Kuznetsova, A. Morales-Muñiz, T. O'Connor, M. Reissmann, M. Hofreiter & A. Ludwig (2011): Genotypes of pre-domestic horses match phenotypes painted in Paleolithic works of cave art. *Proceedings of the National Academy of Sciences USA* 108: 18626-18630.
- Ludwig, A. (2011): To take up the cudgels for inbreeding as tool in conservation biology. *Journal of Applied Ichthyology* 27(S3): 2-4.
- Lippold, S., Knapp, M., Kuznetsova, T., Leonard, J.A., Benecke, N., Ludwig, A., Morten, R., Cooper, A., Weinstock, J., Willerslev, E., Shapiro, B. & M. Hofreiter (2011): Discovery of lost diversity of paternal horse lineages using ancient DNA. *Nature Communications* 2: 450.
- Cieslak, M., M. Reissmann, M. Hofreiter & A. Ludwig (2011): Colours of domestication. *Biological Reviews* 86: 885-899.
- Reinartz, R., S. Lippold, D. Lieckfeldt & A. Ludwig (2011): Population genetic analyses of *Acipenser ruthenus* as a prerequisite for the conservation of the uppermost Danube population. *Journal of Applied Ichthyology* 27: 477-483.

- Cieslak, M., M. Pruvost, N. Benecke, M. Hofreiter, A. Morales, M. Reissmann & A. **Ludwig** (2010): Origin and history of mitochondrial DNA lineages in domestic horses. *PLoS ONE* 5(12): e15311.
- Ludwig**, A., D. Makowiecki, & N. Benecke (2009): Further evidence of trans-Atlantic colonization of Western Europe by American Atlantic sturgeons. *Archaeofauna* 18: 185-192.
- Ludwig**, A., M. Pruvost, M. Reissmann, N. Benecke, G. A. Brockmann, P. Castanos, M. Cieslak, S. Lippold, L. Llorente, A.-S. Malaspinas, M. Slatkin, M. Hofreiter (2009): Coat color variation at the beginning of horse domestication. *Science* 324: 485.
- Ludwig**, A., S. Lippold, L. Debus & R. Reinartz (2009): First evidence of hybridization between endangered sterlets (*Acipenser ruthenus*) and exotic Siberian sturgeons (*Acipenser baerii*) in the Danube River. *Biological Invasions* 11: 753-760.
- Ludwig**, A., U. Arndt, L. Debus, E. Rossello & A. Morales (2009): Ancient mitochondrial DNA analyses of Iberian sturgeons. *Journal of Applied Ichthyology* 25: 5-9.
- Borchers, K., D. Lieckfeldt, A. **Ludwig**, H. Fukushi, G. Allen, R. Fyumagwa & R. Hoare (2008): Detection of Equid herpesvirus 9 DNA in the trigeminal ganglia of a Burchell's zebra from the Serengeti Ecosystem. *The Journal of Veterinary Medical Science* 70: 1377-81.
- East, M. L., G. Wibbelt, D. Lieckfeldt, A. **Ludwig**, K. Goller, K. Wilhelm, G. Schares, D. Thierer & H. Hofer (2008): Infection of spotted hyena with a *Hepatozoon* species genetically distinct from *H. canis* in the Serengeti ecosystem, Tanzania. *Journal of Wildlife Diseases* 44: 45-52.
- Krieger, J., A. K. Hett, P. A. Fuerst, E. Artykhin & A. **Ludwig** (2008): The molecular phylogeny of the order Acipenseriformes revisited. *Journal of Applied Ichthyology* 24(S1): 36-45.
- Ludwig**, A., U. Arndt, S. Lippold, N. Benecke, L. Debus, T. L. King & S. Matsumura (2008): Tracing the first steps of American sturgeon pioneers in Europe. *BMC Evolutionary Biology* 8: 221.
- Ludwig**, A. (2008): Identification of Acipenseriformes species in trade. *Journal of Applied Ichthyology* 24(S1): 2-19.
- Rehbein, H., J. Molkentin, R. Schubring, D. Lieckfeldt & A. **Ludwig** (2008): Development of advanced analytical tools for determination of the origin of caviar. *Journal of Applied Ichthyology* 24(S1): 65-70.
- Schmitt, A. O., J. Schuchhardt, A. **Ludwig**, G. A. Brockmann (2007): Protein evolution within and between species. *Journal of Theoretical Biology* 249: 376-383.
- Frölich, K., J. Fickel, A. **Ludwig**, D. Lieckfeldt, W.J. Streich, R. Jurcik, J. Slamecka & G. Wibbelt (2007): New variants of European brown hare syndrome virus strains in free ranging European brown hare (*Lepus europaeus*) from Slovakia. *Journal of Wildlife Diseases* 43(1): 89-96.
- Peng, Z., A. **Ludwig**, D. Wang, R. Diogo, Q. Wei, & S. He (2007): Age and biogeography of major clades in sturgeons and paddlefishes (Pisces: Acipenseriformes). *Molecular Phylogenetics and Evolution* 42: 854-862.
- Williot, P., T. Rouault, M. Pelard, D. Mercier, M. Lepage, B. Davail-Cuisset, F. Kirschbaum & A. **Ludwig** (2007): Building a broodstock of the critically endangered sturgeon *Acipenser sturio*: Problems and observations associated with the adaptation of wild-caught fish to hatchery conditions. *Cybium* 31: 3-11.
- Borchers, K. D. Böttner, D. Lieckfeldt, A. **Ludwig**, K. Frölich, B. Klingeborn, F. Widèn, G. Allen & H. Ludwig (2006): Characterization of equid herpesvirus 1 (EHV-1) related viruses from captive Grevy's zebra and blackbuck. *The Journal of Veterinary Medical Science* 68: 757-760.
- Freyhof, J., D. Lieckfeldt, N. Bogutskaya, C. Pitra & A. **Ludwig** (2006): Phylogenetic position of the Dalmatian genus *Phoxinellus* and description of the newly proposed genus *Dalmaticichthys* (Teleostei: Cyprinidae). *Molecular Phylogenetics and Evolution* 38: 416-425.
- Krieger, J., A. K. Hett, P. A. Fuerst, V. J. Birstein & A. **Ludwig** (2006): Unusual intraindividual variation of the nuclear 18S rRNA gene is widespread within the Acipenseridae. *Journal of Heredity* 97: 218-225.
- Höner, O. P., B. Wachter, B. S. Speck, G. Wibbelt, A. **Ludwig**, R. D. Fyumagwa, P. Wohlsein, D. Lieckfeldt, H. Hofer & M. L. East (2006): Severe streptococcus infection in spotted hyenas in the Ngorongoro Crater, Tanzania. *Veterinary Microbiology* 115: 223-228.
- Lieckfeldt, D., A. K. Hett, A. **Ludwig** & J. Freyhof (2006): Detection, characterization and utility of

- a new highly variable nuclear marker region in several species of cyprinid fishes (Cyprinidae). *European Journal of Wildlife Research* 52: 63-65.
- Birstein, V. J., G. Ruban, A. **Ludwig**, P. Doukakis & R. DeSalle (2005): The enigmatic Caspian Sea Russian sturgeon: How many cryptic forms does it contain? *Systematic and Biodiversity* 3: 203-218.
- Fickel, J., A. Schmidt, M. Putze, H. Spittler, A. **Ludwig**, W.-J. Streich & C. Pitra (2005): Management implications for European brown hare derived from population genetic structure. *Journal of Wildlife Management* 69: 760-770.
- Freyhof, J., D. Lieckfeldt, C. Pitra & A. **Ludwig** (2005): Molecules and morphology: evidence for introgression of mitochondrial DNA in Dalmatian cyprinids. *Molecular Phylogenetics and Evolution* 37: 347-354.
- Froelich, K., S. Jung, A. **Ludwig**, D. Lieckfeldt, P. Gibert, D. Gauthier & J. Hars (2005): First evidence for a novel pestivirus in Pyrenean chamois (*Rupicapra pyrenaica pyrenaica*) from France. *Journal of Wildlife Diseases* 41: 606-610.
- Hett, A. K. & A. **Ludwig** (2005): SRY-related (Sox) genes in the genome of European Atlantic sturgeon (*Acipenser sturio*). *Genome* 48: 181-186.
- Hett, A. K., C. Pitra, I. Jenneckens & A. **Ludwig** (2005): Characterization of the Sox9 gene in European Atlantic sturgeon (*Acipenser sturio*). *Journal of Heredity* 96: 150-154.
- Lin, L., A. Prassolov, A. Funk, H. Hohenberg, K. Frölich, J. Newbold, A. **Ludwig**, H. Will, H. Sirma & F. Steinbach (2005): Evidence from nature: interspecies spread of heron hepatitis B viruses. *Journal of General Virology* 86: 1335-1342.
- Luenser, K., J. Fickel & A. **Ludwig** (2005): Evolution of ovine and caprine beta-defensin genes. *Immunogenetics* 57: 487-498.
- Luenser, K., J. Fickel, A. Lehnen, S. Speck & A. **Ludwig** (2005): Low level of genetic variability in European bison (*Bison bonasus*) from the Bialowieza National Park in Poland. *European Journal of Wildlife Research* 51: 84-87.
- Luenser, K. & A. **Ludwig** (2005): Variability and evolution of bovine beta-defensin genes. *Genes and Immunity* 6: 115-122.
- Robles, F., R. de la Herran, A. **Ludwig**, C. Ruiz-Rejon, M. Ruiz-Rejon & M. Garrido Ramos (2005): Genomic organization and evolution of the 5S ribosomal DNA in the ancient fish sturgeon. *Genome* 48: 18-28.
- Williot, P., R. Brun, T. Rouault, M. Pelard, D. Mercier & A. **Ludwig** (2005): Artificial spawning in cultured sterlet sturgeon, *Acipenser ruthenus* L., with special emphasis on hermaphrodites. *Aquaculture* 246: 263-273.
- Robles, F., R. de la Herran, A. **Ludwig**, C. Ruiz-Rejon, M. Ruiz-Rejon & M. Garrido Ramos (2004): Evolution of ancient satellite DNAs in sturgeon genomes. *Gene* 338: 133-142.
- Ludwig**, A., L. Congiu, C. Pitra, J. Fickel, J. Gessner, F. Fontana, T. Patarnello & L. Zane (2003): Nonconcordant evolutionary history of maternal and paternal lineages in Adriatic sturgeon. *Molecular Ecology* 12: 3253-3264.
- Wolter, C., F. Kirschbaum & A. **Ludwig** (2003): Sub-population structure of common fish species in the Elbe River estimated from DNA analysis. *Journal of Applied Ichthyology* 19: 278-283.
- Ludwig**, A., L. Debus, D. Lieckfeldt, I. Wirgin, N. Benecke, I. Jenneckens, P. Williot, J. R. Waldman & C. Pitra (2002): When the American sea sturgeon swam east. *Nature* 419: 447-448.
- Ludwig**, A., L. Debus & I. Jenneckens (2002): A molecular approach for trading control of black caviar. *International Review of Hydrobiology* 87: 661-674.
- Zane, L., T. Patarnello, A. **Ludwig**, F. Fontana & L. Congiu (2002): Isolation and characterization of microsatellites in the Adriatic sturgeon (*Acipenser naccarii*). *Molecular Ecology Notes* 2: 586-588.
- Jenneckens, I., J.N. Meyer, G. Hörstgen-Schark, B. May, L. Debus & A. **Ludwig** (2001): A fixed allele at microsatellite locus LS-39 exhibiting species-specificity for the black caviar producer *Acipenser stellatus*. *Journal of Applied Ichthyology* 17: 39-42.
- Ludwig**, A., N. M. Belfiore, C. Pitra, V. Svirsky & I. Jenneckens (2001): Genome duplication events and functional reduction of ploidy levels in sturgeon (*Acipenser*, *Huso* and *Scaphirhynchus*). *Genetics* 158: 1203-1215.

- Ludwig, A., J. Bohlen, C. Wolter & C. Pitra (2001):** Phylogenetic relationships and historical biogeography of spined loaches (Cobitidae, *Cobitis* and *Sabanejewia*) as indicated by variability of mitochondrial DNA. *Zoological Journal of the Linnean Society* 131: 381-392.
- Doukakis P., V. J. Birstein, R. DeSalle, A. **Ludwig**, A. N. Ludwig, A. Machordom, A. Almodóvar & B. Elvira (2000): Failure to confirm previous identification of two putative museum specimens of the Atlantic sturgeon, *Acipenser sturio*, as the Adriatic sturgeon, *A. naccarii*. *Marine Biology* 136: 373-377.
- Jenneckens, I., J.N. Meyer, L. Debus, C. Pitra & A. **Ludwig** (2000): Evidence of mitochondrial DNA clones of Siberian sturgeon, *Acipenser baerii*, within Russian sturgeon, *Acipenser gueldenstaedtii*, caught in the River Volga. *Ecology Letters* 3: 503-508.
- Ludwig, A., B. May, L. Debus & I. Jenneckens (2000):** Heteroplasmy in the mtDNA control region of sturgeon (*Acipenser, Huso* and *Scaphirhynchus*). *Genetics* 156: 1933-1947.
- Ludwig, A., J. Becker & J. Bohlen (2000):** Small differences in cytochrome-*b* sequences within the genus *Sabanejewia*. *Folia Zoologica* 49: 85-90.
- Ludwig, A. & I. Jenneckens (2000):** A PCR test for mitochondrial heteroplasmy in sturgeon. *Animal Genetics* 31: 153-154.
- Ludwig, A. & F. Kirschbaum (1998):** Comparison of mitochondrial DNA sequences between the European and the Adriatic sturgeon. *Journal of Fish Biology* 52: 1289-1291.
- Ludwig, A. & S. Fischer (1998):** New aspects of an old discussion - phylogenetic relationships of *Ammotragus* and *Pseudois* within the subfamily Caprinae based on comparison of the 12S rDNA sequences. *Journal of Zoological Systematic and Evolutionary Research* 36: 173-178.
- Ludwig, A. & J. Knoll (1998):** Multivariate morphometrische Analysen der Gattung *Ovis* Linnaeus, 1758 (Mammalia, Caprinae). *Zeitschrift für Säugetierkunde* 63: 210-219.

Invited Reviews

- Reissmann, M. & A. **Ludwig** (2013): Pleiotropic effects of coat colour-associated mutations in humans, mice and other mammals. *Seminars in Cell and Developmental Biology* 24: <http://dx.doi.org/10.1016/j.semcdb.2013.03.014>.
- Fickel, J., A. Wagener & A. Ludwig (2007): Semen cryopreservation and the conservation of endangered species. *European Journal of Wildlife Research* 53: 81-89. **One of the 10 most downloaded articles of this journal from 2008 to 2010**
- Ludwig, A. & J. Gessner (2007):** What makes the difference? – Sea sturgeon on both sides of the Atlantic Ocean. *American Fisheries Society Symposium* 56: 285-300.
- Gessner, J., G.-M. Arndt, A. **Ludwig** & F. Kirschbaum (2007): Remediation of Atlantic sturgeon *Acipenser oxyrinchus* in the Baltic Sea - background, status, and perspectives. *American Fisheries Society Symposium* 56: 301-317.
- Ludwig, A. (2006):** A sturgeon view on conservation genetics. *European Journal of Wildlife Research* 52: 3-8.
- Kirschbaum, F., A. **Ludwig**, E. Hensel, S. Würtz, W. Kloas, P. Williot, R. Tiedemann, M.G. Arndt, E. Anders, H. v. Nordheim & J. Gessner (2004): Status of the protection and restoration of Atlantic sturgeon in Germany: background, actual situation, and perspectives. *BfN-Skripten* 101: 36-53.
- Ludwig, A. & N. Benecke (2003):** Zur Systematik und Paläontologie der Gattung *Ovis* mit besonderer Berücksichtigung der Stellung des Europäischen Mufflons. *Beiträge zur Jagd- und Wildforschung* 28: 35-45.

Books

- Ludwig, A. & IUCN Species Programme (2007):** Identification of Acipenseriformes species in trade. IUCN, Gland, Switzerland (http://www.cites.org/common/prog/sturgeon/id_sturgeon_iucn.pdf).