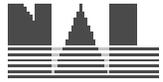




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# Information Resources on Fish Welfare

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The Animal Welfare Information Center also gratefully acknowledges **BIOSIS**, a leading not-for-profit organization whose mission is to foster the growth, communication, and use of biological knowledge for the common good. The citations and abstracts are made available courtesy of BIOSIS, Biological Abstracts Inc., Two Commerce Square, 2001 Market Street, Suite 700, Philadelphia, PA 19103-7095. BIOSIS is a registered trademark of Biological Abstracts, Inc. More information on BIOSIS is available at <http://www.biosis.org/>.

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## Preface

Fish are a valuable commodity to the United States, providing: 1) recreation in the form of angling, 2) food and feed products from aquaculture and fisheries, 3) jobs in the aquaculture and fisheries industries, and are 4) excellent alternative lower phyla animals for necessary research. The use of fish in research has been increasing over the last 10 years (DeVita 1984; Post 1987; Powers 1989; Goodrich 1990; Evans 1993; Stoskopf 1993). At the same time, the progress of fish as a food source has also grown, with aquaculture being one of the most rapidly expanding food industries. This in part is due to the fact that fish are seen as a low-fat food source, as a replacement for fat-rich meats, and consequently more emphasis is being placed on the amount of fish consumed, the quality of fish produced, and the efficiency of fish growth (DeTolla et al. 1995). Aquaculture research facilitates addressing questions regarding environmental pollution, conservation, and protection of the freshwater estuarine and marine environment (DeTolla et al. 1995). And these factors in turn should also stimulate research performed directly on fish in their natural habitat, where fish are also subjected to environmental stresses (man-made and otherwise) that can harm their health and well-being (DeTolla et al. 1995). Besides aquaculture and fisheries research, fish are increasingly used in the laboratory as animal models in toxicologic, pharmacologic, and genetic studies that might otherwise employ mice or other mammalian species, as a result to greater concerns about the humane use of higher vertebrates in research (DeTolla et al. 1995). A great deal of what we need to know regarding fish welfare is yet to be discovered as the scientific study of fish welfare is at an early stage compared to research efforts on other vertebrates (FSBI 2002). In all, these activities and research increase the knowledge base on the care and use of these species in aquaculture, fisheries, and the laboratory.

People whose sports or hobbies involve fish, whose professional work involves fish, and who are concerned with the general welfare of animals search for the answers to the questions regarding the consequences of human activities on fish welfare (FSBI 2002). As you may or may not be aware of, the topic of fish welfare has been receiving much debate lately in the United States. This subject is being discussed related to angling, aquaculture, general neurophysiology, fisheries, laboratory research, aquariums, and regulation, with the issue of whether or not fish feel pain at the forefront. This increase in public concern is witnessed by numerous web sites, commentaries and reports, not only in the United States, but worldwide as well. And mounting concern for fish welfare is also echoed in the activities of those studying or using fish (FSBI 2002).

Laws, government policies, procedures, and protocols that require humane treatment of animals for all uses (e.g. Animal Welfare Act (7 U.S.C. 2131 et seq.)), *Guide for the Care and Use of Laboratory Animals* originally by the National Institutes of Health and revised by the National Research Council (1996), *Policy on the Humane Care and Use of Laboratory Animals* by the Public Health Service (PHS; 1997), and federally mandated "institutional animal care and use

committees" (IACUC) came about due to trepidations regarding the welfare and use of animals in biomedical laboratory research. These research projects are thus reviewed to make sure that projects using animals are necessary and conducted as humanely as possible.

Evaluation of animal well-being should be based on subtle behavioral and physiological changes as well as established environmental limits (FSBI 2002). Because fish are different in ways that are important when considering their welfare, including species, body temperature, stocking densities, vulnerability to poor or polluted water quality, and context dependent characteristics, it can be deceptive to extrapolate from what we know about the welfare of mammals and birds to fish, (FSBI 2002). Therefore, common criteria for welfare of other vertebrate animals should be modified to include fish related criteria, as listed above, before welfare criteria can be usefully applied to fish (FSBI 2002).

The optimum health requirements for major farm-raised species are known. However, requirements for other species are being determined by ongoing research that aims at defining the unique limits of each. Consequently, the amount of information available concerning health requirements varies considerably depending on the species. An understanding of the health requirements for a species increases with the length of time it is commercially cultured and its economic importance. We know much more about how to evaluate the well-being of traditionally cultured species, such as channel catfish, goldfish, fathead minnows, golden shiners, rainbow trout, various ornamentals, and zebrafish than we do about newer culture species.

Respect, for all forms and systems of life, is an intrinsic attribute of scientists and managers who conduct any type of research on fish. The respectful treatment of wild and cultured fishes in research is both an ethical and a scientific necessity (AFS Policy Statements #16, 22, 30). Traumatized animals (including fish) may show signs of abnormal physiological, behavioral, and ecological responses that defeat the purposes of the investigation (AFS Policy Statements #16, 22, 30). Because of the very considerable range of adaptive diversity and husbandry requirements represented by the over 20,000 species of fishes, no concise or specific compendium of approved methods and guidelines for fish research is practical or desirable (AFS Policy Statements #16, 22, 30, DeTolla et al. 1995). The attainment of new knowledge and understanding comprises a major justification for any investigation, with the definitive responsibility for the ethical and scientific validity of an investigation and the methods employed resting with the investigator (AFS Policy Statements #16, 22, 30, DeTolla et al. 1995).

Presently, the Animal Welfare Act does not cover cold-blooded vertebrates. In response to the 1985 amendment to the Animal Welfare Act, that extended principles of humane laboratory animal care to field research activities, the American Fisheries Society – in cooperation with the American Society of Ichthyologists and Herpetologists, and the American Institute of Fishery Research Biologists – developed and published the “Guidelines for Use of Fishes in Field Research” (Nickum 1988) to build on and extend these ethical guidelines to the field, thus

promoting the conduct of all fisheries work in a humane manner that eliminates cruelty and minimizes suffering (AFS Policy Statements #16).

In PHS funded institutions, the *Guide* covers all vertebrate species, but the specific use of fish and other cold blooded species is not addressed. Even though the *Guide* and PHS *Policy* do not provide guidelines for the use of laboratory fish, the Office of Laboratory Animal Welfare (OLAW) states, 'Many of the principles embodied in the *Guide*, although not specifically addressing cold-blooded vertebrates, generally can be adapted to animal care and use programs for various kinds of amphibians, reptiles, and fishes (1996)' (Matthews et al. 2002). All institutions are expected to care for and use fish in research in a manner judged to be professionally and humanely appropriate for the particular species in question (DeTolla et al. 1995). Although fish differ from both warm-blooded and other cold-blooded species, like their endothermic counterparts they need to be maintained in a controlled environment with a limitation on stress (DeTolla et al. 1995).

To assist persons using fish in all types of research, numerous reviews and guidelines have been prepared by various experts in each of the fields. The American Fisheries Society has put out several policy statements regarding the use of fish in general and in field research. Thorsteinsson (2002) published a report on fish welfare and health related to tagging methods for fish research. Schwedler and Johnson (2000) produced an article discussing the responsible husbandry of fish in commercial aquaculture. DeTolla et al. (1995) published guidelines for the care and use of fish in research. Westerfield (2000) published the guide for the laboratory use of zebrafish, which was followed up by Matthews et al. (2002) who published a review of the *Guide* for zebrafish care and users. As a general look at the current state of fish welfare, FSBI (2002) produced a report addressing general fish welfare. The Canadian Council on Animal Care (CCAC) has posted its second draft of CCAC guidelines on: the care and use of fish in research, testing, and teaching. The draft guidelines and future final guidelines are available at the CCAC webpage (<http://www.ccac.ca/> and <http://www.ccac.ca/english/new/newframe.htm>).

As the concerns about fish welfare are heating up and not all information can be easily obtained in one source. The Information Resources on Fish Welfare has been designed to provide the most current worldwide data available regarding fish welfare for use by both those who have knowledge in one of the various fish related fields or may even be professionals in a fish related field, as well as for individuals who are interested in learning more about fish welfare issues. This publication does not present an opinion on the subject but is rather a comprehensive review of the available information resources regarding fish welfare and its related issues. In this timely publication, AWIC, in cooperation with various authors and publishing houses, provides twelve national and international current review articles and guidelines, which cover the topics of general fish welfare, pain and awareness related to fish, and fish welfare related to aquaculture, laboratory and field research, and fisheries. In addition to the review articles, a thorough review

of the literature (including citations with abstracts and web sites) is presented, including the following topics: 1) general fish welfare related topics: alternatives; anesthesia and euthanasia; awareness, cognitive ability, and fear; pain and distress; and health and welfare; 2) culture, fisheries, and research related topics: angling; aquaculture; fisheries; laboratory; aquarium fishes (including general topics, ornamentals, dealers, and pet shops); and selected husbandry topics (including animal domestication, harvest and slaughter, holding and transport, and tagging); and 3) regulatory issues (including a table of national and international animal welfare acts related to fish). As an additional resource for institutional animal care and use committees (IACUC), a section on fish related IACUC web resources are provided. Educational training materials and courses are presented for those wishing to delve further into educating themselves and their facility employees about fish welfare.

AWIC presents this material to provide the various fish communities and regulatory agencies worldwide a comprehensive resource on fish welfare. As this publication does not present an opinion regarding fish welfare, we at USDA AWIC hope that the national and international readers (producers, researchers, IACUC members, government representatives, aquarists, and general public) will use the scientifically based guidelines and information to answer the questions regarding the impact of human activities on fish welfare in his or her field, for his or her species, and to act accordingly to prepare and follow humane procedures for the care and husbandry of aquatic animals. This publication is also presented as a resource for United States Federal Government grant applicants and awardees that will use fish in their proposed research.

Heidi S. Erickson  
Beltsville, Maryland

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## How to Use This Document

This publication is a comprehensive review of the available information resources regarding fish welfare and its related issues. Bibliography citations are arranged alphabetically according to the last name of the primary author. Each entry also contains abstracts, if available, descriptors, and the NAL call number if the record was retrieved from the National Agricultural Library's Agricola database. If the full-text of the article/resource is available on the WWW, the URL is provided. At the end of each subsection are listings of World Wide Web sites that will provide additional information on the topic. Readers are cautioned as to the dynamic nature of the internet and the fact that addresses and content are subject to change. Web addresses are current as of September 2003.

This document is divided into seven sections: 1) introduction, 2) selected key review articles, 3) a comprehensive review of the literature available in electronic databases, 4) fish related institutional animal care and use committee (IACUC) web resources, 5) current educational training materials and courses, 6) Cooperative State Research, Education, and Extension Service (CSREES) Current Research Information System Reports (CRIS), and 7) additional records from the National Agricultural Library Electronic Catalog.

This document also contains a list of aquaculture and fisheries professional associations, groups, and societies including their web addresses.

## **Selected Review Articles**

Twelve key review articles written by national and international experts in various topics relating to fish welfare are included in this section. Each article concludes with a list of references cited by the author.

## **Review of the Literature**

The selected records in this section were compiled from multiple sources and numerous databases including, but not limited to Agricola, Medline, NTIS, AGRIS, CAB International, BIOSIS, and ASFA databases. Citations listed in this section may or may not overlap with articles cited by the introductory authors. Each section also has relevant websites that will provide additional material not found in journals or databases. World Wide Web addresses are listed to access specialized databases, extension materials, and publications produced by a variety of non-profit organizations.

## **Fish Related Institutional Animal Care and Use Committees (IACUC) Web Resources**

The selected relevant materials regarding fish welfare in research and the IACUC in this section were compiled from the internet. The URLs are listed to access specialized databases and linkages, extension materials, and publications produced by a variety of non-profit organizations.

## **Educational Training Materials and Courses**

The selected relevant educational training materials and courses in this section were compiled from multiple sources and the internet. Those materials cited also have relevant websites listed that will provide additional information regarding the educational training materials or courses.

## **Cooperative State Research, Education, and Extension Service (CSREES) Current Research Information System (CRIS) Reports**

Records in this section were retrieved from the Current Research Information System maintained by the Cooperative State Research, Education, and Extension Service. CRIS is the U.S. Department of Agriculture's (USDA) documentation and reporting system for ongoing and recently completed research projects in agriculture, food and nutrition, and forestry. Projects are conducted or sponsored by USDA research agencies, state agricultural experiment stations, the state land grant university system, other cooperating state institutions, and participants in a number of USDA research grant programs. It is available on the web at <http://cris.csrees.usda.gov/>.

## **National Agricultural Library Electronic Catalog**

Generally, this resource is closely related to Agricola. However, some relevant materials not appearing in the Agricola database were retrieved and included here.

## **Aquaculture and Fisheries Professional Associations, Groups and Societies**

This section contains a list of topic related professional societies and groups available from electronic sources. The URL is listed below each citation and should be accessed to obtain further contact information for the individual professional society or group.

## **National Agricultural Library Document Delivery Information**

Information on how to obtain copies of articles mentioned in the bibliography are available from the National Agricultural Library's Document Delivery Services Branch at <http://www.nal.usda>.

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<http://www.nal.usda.gov/awic/pubs/fishwelfare/fishwelfare.htm>

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