

Northern Wild Sheep and Goat Council

Proceedings of the Twenty-fourth
Biennial Symposium

April 30–May 3, 2024
Anchorage, Alaska





Northern Wild Sheep and Goat Council



PROCEEDINGS OF THE 24TH BIENNIAL SYMPOSIUM

**APRIL 30–MAY 2, 2024
ANCHORAGE, ALASKA**

Host: Alaska Department of Fish & Game

Chair: Todd Rinaldi

Financial and Accommodations Coordination: Todd Rinaldi

Sponsor Solicitation: Darren Bruning, Tony Kavalok, Todd Rinaldi, Becky Schwanke, and Kevin Hurley

Field Trip Coordination: Darren Bruning, Heidi Hatcher, Karen Gordon, and Dave Schirokauer

Registration: Manny Eichholz

Chair Business Meeting: Kevin Hurley

Plenary Speakers: Dale Toweill PhD. and Wayne Heimer

Panel Speakers: Shannon Clairmont, Frances Cassirer PhD., Rich Harris PhD., Catherine Pinard, Tom Stephenson PhD., and Tony Kavalok (Moderator)

Program Committee: Roy Churchill PhD., Ross Dorendorf, Kristin Denryter PhD., and Heidi Hatcher

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The Northern Wild Sheep and Goat Council is a non-profit professional organization developed in 1978 from the Northern Wild Sheep Council. Proceedings may also be downloaded from the NWSGC website. www.nwsqc.org

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We would like to thank our many sponsors for their generous contributions and support for this symposium!



**Robert &
Cynthia Cassell**



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NORTHERN WILD SHEEP AND GOAT COUNCIL SYMPOSIA

Date	Symposium	Location	Symposium Coordinator/Chair	Proceedings Editor(s)	NWSGC Executive Director
May 26–28, 1970	NWSC 1	Williams Lake, BC	Harold Mitchell		
April 14–15, 1971	NAWSC 1	Fort Collins, CO	Eugene Decker/Wayne Sandfort	Eugene Decker	
April 11–13, 1972	NWSC 2	Hinton, AB	E.G. Scheffler		
April 23–25, 1974	NWSC 3	Great Falls, MT	Kerry Constan/James Mitchell		
Feb. 10–12, 1976	NWSC 4	Jackson, WY	E. Tom Thorne		
April 2–4, 1978	NWSGC 1	Penticton, BC	Daryll Hebert/M. Nation	Daryll Hebert/Michael Nation	
April 23–25, 1980	NWSGC 2	Salmon, ID	Bill Hickey		
March 17–19, 1982	NWSGC 3	Fort Collins, CO	Gene Schoonveld	James Bailey/Gene Schooneveld	
Apr. 30–May 3, 1984	NWSGC 4	Whitehorse, YK	Manfred Hoefs	Manfred Hoefs	Wayne Heimer
April 14–17, 1986	NWSGC 5	Missoula, MT	Jerry Brown	Gayle Joslin	Wayne Heimer
April 11–15, 1988	NWSGC 6	Banff, AB	Bill Wishart	Bill Samuel	Wayne Heimer
May 14–18, 1990	NWSGC 7	Clarkston, WA	Lloyd Oldenburg	James Bailey	Wayne Heimer
Apr. 27–May 1, 1992	NWSGC 8	Cody, WY	Kevin Hurley	John Emmerich/Bill Hepworth	Wayne Heimer
May 2–6, 1994	NWSGC 9	Cranbrook, BC	Anna Fontana	Margo Pybus/Bill Wishart	Kevin Hurley
Apr. 30–May 3, 1996	NWSGC 10	Silverthorne, CO	Dale Reed	Kevin Hurley/Dale Reed/Nancy Wild (compilers)	Kevin Hurley
April 16–20, 1998	NWSGC 11	Whitefish, MT	John McCarthy	John McCarthy/Richard Harris/Fay Moore (compilers)	Kevin Hurley
May 31–June 4, 2000	NWSGC 12	Whitehorse, YK	Jean Carey	Jean Carey	Kevin Hurley
April 23–27, 2002	NWSGC 13	Rapid City, SD	Ted Benzon	Gary Brundige	Kevin Hurley
May 15–22, 2004	NWSGC 14	Coastal Alaska	Wayne Heimer	Wayne Heimer/Dale Towell/Kevin Hurley	Kevin Hurley
April 2–6, 2006	NWSGC 15	Kananaskis, AB	Jon Jorgenson	Margo Pybus/Bill Wishart	Kevin Hurley
April 27–May 1, 2008	NWSGC 16	Midway, UT	Anis Aoude	Tom Smith	Kevin Hurley
June 7–11, 2010	NWSGC 17	Hood River, OR	Craig Foster	Vern Bleich	Kevin Hurley
March 12–15, 2012	NWSGC 18	Kamloops, BC	Steve Gordon/Steve Wilson/Mari Wood	Steve Wilson/Mari Wood	Kevin Hurley



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NORTHERN WILD SHEEP AND GOAT COUNCIL SYMPOSIA (Cont'd)

Date	Symposium	Location	Symposium Coordinator/Chair	Proceedings Editor(s)	NWSGC Executive Director
June 2–5, 2014	NWSGC 19	Fort Collins, CO	Janet George	Bruce Watkins, Ricki Watkins	Kevin Hurley
May 9–12, 2016	NWSGC 20	Moscow, ID Pullman, WA	Hollie Miyasaki/Rich Harris/ David Smith	Rich Harris	Kevin Hurley
May 21–24, 2018	NWSGC 21	Whitefish, MT	Brent Lonner/Bruce Sterling/ Caryn Dearing	Justin Gude	Kevin Hurley
November 3–5, 2020	NWSGC 22	Alberta (virtual)	Beth MacCallum	Kathreen Ruckstuhl	Kevin Hurley
April 4–7, 2022	NWSGC 23	Jackson, WY	Doug McWhirter	Doug McWhirter/Aly Courtemanch/Peach Van Wick	Kevin Hurley
April 29–May 2, 2024	NWSGC 24	Anchorage, AK	Todd Rinaldi	Todd Rinaldi	Kevin Hurley



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GUIDELINES OF THE NORTHERN WILD SHEEP AND GOAT COUNCIL

The purpose of the Northern Wild Sheep and Goat Council is to foster wise management and conservation of northern wild sheep and goat populations and their habitats.

This purpose will be achieved by:

- 1) Providing for timely exchange of research and management information;
- 2) Promoting high standards in research and management; and
- 3) Providing professional advice on issues involving wild sheep and goat conservation and management.

I. The membership shall include professional research and management biologists and others active in the conservation of wild sheep and goats. Membership in the Council will be achieved either by registering at, or purchasing proceedings of, the biennial conference. Only members may vote at the biennial meeting.

II. The affairs of the Council will be conducted by an Executive Committee consisting of: three elected members from Canada; three elected members from the United States; one ad hoc member from the state, province, or territory hosting the biennial meeting; and the past chairperson of the Executive Committee. The Executive Committee elects its chairperson.

III. Members of the Council will be nominated and elected to the executive committee at the biennial meeting. Executive Committee members, excluding the ad hoc member, will serve for four years, with alternating election of two persons and one person of each country, respectively. The ad hoc member will only serve for two years.

The biennial meeting of members of the Council shall include a symposium and business meeting. The location of the biennial meeting shall rotate among the members' provinces, territories and states. Members in the host state, province or territory will plan, publicize and conduct the symposium and meeting; will handle its financial matters; and will prepare and distribute the proceedings of the symposium.

The symposium may include presentations, panel discussions, poster sessions, and field trips related to research and management of wild sheep, mountain goats, and related species. Should any member's proposal for presenting a paper at the symposium be rejected by

members of the host province, territory or state, the rejected member may appeal to the Council's executive committee. Subsequently, the committee will make its recommendations to the members of the host state, territory or province, for a final decision.

The symposium proceedings shall be numbered with 1978 being No. 1, 1980 being No. 2, etc. The members in the province, territory or state hosting the biennial meeting shall select the editor(s) of the proceedings. Responsibility for quality of the proceedings shall rest with the editor(s). The editors shall strive for uniformity of manuscript style and printing, both within and among proceedings. The proceedings shall include edited papers from presentations, panel discussions or posters given at the symposium. Full papers will be emphasized in the proceedings. The editor will set a deadline for submission of manuscripts.

Members of the host province, territory, or state shall distribute copies of the proceedings to members and other purchasers. In addition, funds will be solicited for distributing a copy to each major wildlife library within the Council's states, provinces, and territories.

IV. Resolutions on issues involving conservation and management of wild sheep and goats will be received by the chairperson of the Executive Committee before the biennial meeting. The Executive Committee will review all resolutions and present them with recommendations at the business meeting. Resolutions will be adopted by a plurality vote. The Executive Committee may also adopt resolutions on behalf of the Council between biennial meetings.

V. Changes in these guidelines may be accomplished by plurality vote at the biennial meeting.



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FOREWORD

The papers and abstracts included in these proceedings were presented during the 24th Biennial Symposium of the Northern Wild Sheep and Goat Council, held April 30–May 3, 2024, in Anchorage, Alaska, at the Hotel Captain Cook. The theme was “*Recovering Populations in a Changing Environment*”. The myriad challenges faced by mountain sheep and mountain goats in Alaska and other northern jurisdictions were skillfully addressed by our keynote speakers, technical presenters, and panelists. To our more than 40 speakers, panelists, and poster presenters, thank you each for sharing your experiences, your data, your perspectives, and your recommendations for enhancing the status and management of mountain sheep and mountain goats in Alaska and beyond.

Special thanks to Chair Todd Rinaldi of the Alaska Department of Fish and Game (ADF&G) for leading a dedicated Alaska Symposium Planning Group, largely composed of current and former ADF&G personnel, supplemented by volunteers from the University of Alaska, the National Park Service, and the Alaska Chapter of the Wild Sheep Foundation. Thanks to all the Alaska Planning Group members who put so much effort into organizing a timely, focused agenda, with a diverse spectrum of speakers and technical experts. Logistically and topically, the field trips were not only enjoyable but also allowed many attendees the chance to experience some of Alaska’s magic landscapes and wildlife, some for the first time. We also thank Denali National Park for hosting a post-symposium field trip providing attendees with an opportunity to experience this iconic region.

Thanks to Manny Eicholz of ADF&G for handling a complicated registration process and the fiscal components of such a large gathering. Thanks to Heidi Hatcher and Roy Churchwell of ADF&G for managing the abstract submission process and arranging the final symposium agenda. Appreciation also to session moderators who worked skillfully to keep the presenters and sessions on time!

Heartfelt thanks are extended to the sponsors who helped make this symposium happen! Please take note of all the symposium sponsors displayed on page ii of these Proceedings. We simply could not hold these biennial symposia without the strong support of many diverse, dedicated individuals, organizations, agencies, and supporters of mountain sheep and mountain goat conservation.

These Proceedings were edited by Todd Rinaldi. Peer-reviewers included Julie Cunningham, Rich Harris, and Roy Churchwell. Suggested editorial comments were provided to each senior author; senior authors had opportunity(ies) to accept or reject suggested edits, prior to submission of their final manuscripts. Formatted page proofs were forwarded to respective senior authors prior to inclusion into the final proceedings. Final content, particularly verification of literature citations, is the responsibility of the authors.

While NWSGC strives for professional, scientific presentations at our symposia, followed up with quality manuscripts for our proceedings, NWSGC Guidelines do not rigidly specify format, minimum data requirements, or thresholds of statistical analysis for subsequently included manuscripts. Thus, NWSGC Proceedings may contain manuscripts that are more opinion-based than data- or fact-based; critical evaluation of information presented in these proceedings is the responsibility of subsequent readers.

Kevin Hurley
NWSGC (volunteer) Executive Director
March 16, 2026



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IN MEMORIAM



Dr. James A. Bailey

May 14, 1934—May 30, 2023

Jim Bailey passed away at this home in Montana on May 30, 2023.

A longtime contributor, advocate, and lifelong member of the Northern Wild Sheep and Goat Council, Dr. Bailey served as instructor in wildlife management at the University of Montana, 1968-69, and landed an instructorship at Colorado State University in 1969. At Colorado State, he taught Principles of Wildlife Management, Wildlife Nutrition, Big Game Management, and Population Dynamics, among other courses. He was senior editor, assembling the book,

Readings in Wildlife Conservation for The Wildlife Society in 1974, and published Principles of Wildlife Management with John Wiley & Sons in 1984.

Dr. Bailey mentored several graduate students at Colorado State, concentrating research on wild ungulates, especially bighorn sheep and mountain goats. He retired from Colorado State as a full professor in 1990.

He was a member of the Colorado and New Mexico chapters of The Wildlife Society, the Gallatin Wildlife Association, a Life Member of the Rocky Mountain Bighorn Society, the Desert Bighorn Council and the Northern Wild Sheep and Goat Council.

Jim's last great act for wildlife conservation was his tireless advocacy for wild bison. Dr. Bailey's consistent and impassioned message to his fellow wildlifers was "We can do better". Thank you, Dr. Bailey, for issuing this worthwhile challenge.



James Russell Allen

June 13, 1952—June 13, 2023

James "Jim" Russell Allen passed away peacefully on June 13, 2023.

James began his advanced wildlife education at Vermilion (Lakeland) College earning a Fish and Wildlife Technician Diploma and ended many years later with a Master's Degree in Environmental Sciences from the University of Alberta. He worked for 43 years as a wildlife biologist and wildlife manager for the Alberta government at Red Deer, Drumheller, Rocky Mountain House, Edson, Edmonton and ended his career back in Rocky Mountain House where he retired.

He served as Head of Game Management and Priority Species Section for the Alberta government. He was a long-term member of the Northern Wild Sheep and Goat Council as well as The Wildlife Society, serving on the board of directors for both the Canadian Section and the Alberta Chapter, also serving a term as President of the Alberta Chapter. He also worked with many non-government wildlife organizations like the Alberta Trapper's Association, Alberta Fish & Game Association, the Wild Sheep Foundation, Alberta Professional Outfitters Association, and



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many others. James was an avid hunter and fisherman and especially loved horse trips to the mountains and primitive weapons hunts.

Kevin Hurley and many NWSGC folks knew and worked with Jim Allen for many years, on a variety of ungulate management issues and strategies. Most notably, Jim volunteered to be on the WAFWA Wild Sheep Working Group's initial effort in 2007 to develop the first iteration of WAFWA's 'Recommendations for Domestic Sheep and Goat Management in Wild Sheep Habitat'; this document was revised in 2010, again in 2012, and is undergoing update/revision again in 2024. "Jim was a very capable biologist, a solid resource to turn to for practical advice, and he was a good man. The wild sheep and goat world misses a guy like Jim Allen."