

ANNOTATED BIBLIOGRAPHY SERIES IN SUPPORT OF COASTAL COMMUNITY
HAZARD PLANNING—NORTHWEST ALASKA



GAMBELL, ALASKA

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This annotated bibliography is part of a series created to facilitate access to documents useful for coastal geohazard evaluation and community planning in Northwest Alaska. Below is a comprehensive list of community-specific information sources, each with full bibliographic information and an informative-style annotation that highlights content pertaining to the community of Gambell, Alaska. For a detailed description of the preparation and scope of this resource, please refer to this bibliography series' foreword. Any notable errors and/or omissions may be reported to the Coastal Hazards Program manager at the Alaska Division of Geological & Geophysical Surveys (DGGGS).

Alaska Department of Commerce, Community & Economic Development (DCCED), accessed 2011, Division of Community & Regional Affairs (DCRA) Community Profiles [website]: Department of Commerce, Community & Economic Development.

<http://www.commerce.state.ak.us/dca/profiles/profile-maps.htm>

This website provides access to community profile maps for community-based planning. The maps are available in 24" by 36" and 30" by 42" formats. The Gambell maps were created in 2004, 1996, and 1980 based on land surveys and/or interpretation of aerial imagery. Subsistence hunting grounds, habitat areas, community buildings, and public facilities are delineated. Shoreline position and potential erosion zones are included in the map content. All maps have been sponsored by the Alaska Division of Community & Regional Affairs and contracted to local agencies for production.

Alaska Department of Natural Resources Division of Coastal and Ocean Management (DCOM), accessed February 2011, Alaska coastal management program [website]: Alaska Department of Natural Resources Division of Coastal and Ocean Management.

<http://alaskacoast.state.ak.us/Explore/Tour.html>

This website outlines the Alaska Coastal Management Plans for each coastal district. It provides stewardship plans "to ensure a healthy and vibrant Alaskan coast that efficiently sustains long-term economic and environmental productivity."

Antioquia, C., W.E. Stephens, and G. Longley, January 1977, Gambell—Its history, population and economy: U.S. Bureau of Indian Affairs (BIA), Billings, MT, 255 p.

This study was done to provide the people of Gambell with the analytical and planning information required for the economic development of St. Lawrence Island resources. Information from the U.S. Census report was used to determine the human resource characteristics. The history of the communities housing, transportation, and communication, governmental and interrelated community entities/organizations, and natural resources are described in detail.

Blier, Warren, Stanley Keefe, Wilson A. Shaffer, and Sung C. Kim, December 1997, Storm surges in the region of western Alaska: Monthly Weather Review, vol. 125 p. 3094–3108.

The authors describe the relationship between storm surges in Alaska and extratropical cyclones. They have identified Norton Sound and the Bering Sea as the two regions most vulnerable to cyclone-linked coastal flooding. A statistical storm surge model was developed to provide advanced warning to coastal villages, however, the author highlights that a more accurate model would be necessary to utilize this warning system as a hazard mitigation strategy. The installation of storm surge gauges would also be required for this warning system to be used successfully.

Brigham-Grette, Julie, and David M. Hopkins, 1995, Emergent marine record and paleoclimate of the last interglaciation along the northwest Alaskan coast: *Quaternary Research*, vol. 43, p. 159–173.

This paper describes the stratigraphy of deposits from the last interglaciation in the Beringian region of Alaska and summarizes biostratigraphic information used to infer past water-mass and sea-ice conditions in the Bering Strait and southern Arctic Ocean.

Danielson, Seth, and Zygmunt Kowalik, October 2005, Tidal currents in the St. Lawrence Island region: *Journal of Geophysical Research*, vol. 110, no. C10004, 18 p.

Historical and newly available nearshore and offshore current meter data from the vicinity of St. Lawrence Island are used to more fully describe the spatial and temporal variability associated with tidal currents around the island.

Denali Commission, March 2011, Road and waterfront project selections, fiscal year 2006–2011: Denali Commission, 9 p.

This report contains an overview of all of the funding dispersed by the Denali Commission Transportation Program from 2006–2011. The document is organized by partner agency/project and includes a description of the project status. \$850,000 was awarded to Gambell for documentation and construction of an evacuation road in 2011.

Hopkins, David M., C.H. Nelson, R.B. Perry, and Tau Rho Alpha of U.S. Geological Survey (USGS), National Ocean Survey, and National Oceanographic and Atmospheric Administration (NOAA), March 1976, Physiographic subdivisions of the Chirikov Basin, northern Bering Sea: U.S. Government Printing Office, Washington, DC, professional paper no. 759-B, 12 p.

This northern Bering Sea study is the result of a collaboration between the United States Geological Survey (USGS) and the National Oceanic and Atmospheric Administration (NOAA). Bathymetric complexities are compared to extensive sedimentological and geophysical studies to provide critical insights into the Cenozoic history of the Chirikov Basin. Physiographic units are described stemming from a discussion of the Quaternary tectonic, erosional, and depositional history of the northern Bering Sea.

Hopkins, David M., Robert W. Rowland, and William W. Patton Jr., 1972, Middle Pleistocene mollusks from St. Lawrence Island and their significance for the paleo-oceanography of the Bering Sea: *Quaternary Research*, vol. 2, p. 119–134.

This report discusses how the fossiliferous marine beds of St. Lawrence Island provide insight into former ocean current circulation patterns in the northern Bering Sea region and how the glacial drift that covers these beds provides evidence of former glaciations in the vicinity of Anadyr Strait. The species of molluscan fauna observed within each profile on St. Lawrence Island were characterized and compared to documented collections from the region in order to develop an understanding of the patterns mentioned above.

Immediate Action Workgroup (IAWG), Michael Black and Patricia Opheen, eds., March 2009, Recommendations to the Governor's Subcabinet on climate change: Immediate Action Workgroup, 162 p.

The Immediate Action Workgroup was established to address known threats to Alaskan communities caused by coastal erosion, thawing permafrost, flooding, and fires. This report is a follow-up to the recommendations made in April 2008 (in which Gambell was not mentioned), and provides recommendations for actions and policies to be implemented in 2009 and 2010.

The community of Gambell has been recognized as receiving agency actions from the Alaska Department of Transportation & Public Facilities. The status of the Gambell evacuation road is also mentioned in this report.

Johnson, Walter R., and Zygmunt Kowalik, April 1986, Modeling of storm surges in the Bering Sea and Norton Sound: *Journal of Geophysical Research*, vol. 91 no. C4, p. 5119–5128.

Based on the results of a numerical model used to examine sea level, currents, and ice distribution during Bering Sea storm events, the authors suggest that the presence of land-fast ice in Norton Sound has a measurable effect on the size and onshore arrival time of storm surge events. Both land-fast and pack ice are included as parameters in the model runs. The model is validated using observations and measurements from the February 1982, March 1982, and November 1974 storm events and reproduces observations of sea ice redistribution during these storm events.

Kapsch, Marie-Luise, Hajo Eicken, and Martin Robards, 2010, Chapter 5, Sea ice distribution and ice use by indigenous walrus hunters on St. Lawrence Island, Alaska of SIKU—Knowing Our Ice: Springer, p. 115–144.

In this chapter from the Sea Ice Knowledge and Use project, the authors correlate reported weather and ice conditions with favorable walrus hunting conditions in the vicinity of Gambell and Savoonga, Alaska. Since walrus are dependent upon sea ice distribution and abundance, the ability of indigenous people to hunt the animal reflects surface climatology locally and regionally. The study focus is from 2006–2008, during a significantly low minimum summer ice extent in the Pacific.

Krupnik, Igor, Leonard Apangalook, Sr., and Paul Apangalook, 2010, Chapter 4, “It’s cold, but not cold enough”—Observing ice and climate change in Gambell, Alaska, in IPY 2007–2008 and Beyond of SIKU: Knowing Our Ice: Springer Science Business Media B.V., p. 81–114.

In this chapter from the Sea Ice Knowledge and Use project, the authors discuss the outcome of an observational study of ice and weather conditions in Gambell, Alaska. In an effort to develop a systematic way of recording daily ice and weather patterns, indigenous community members were recruited to collect data for incorporation into scientific studies. This chapter describes the history and scope of documented observations in Gambell over a 33-month period from 2006–2009. Observations include descriptions of seasonal ice and weather variation, as well as a record of subsistence hunting activities.

Mason, Owen K., and James W. Jordan, 2002, Minimal late Holocene sea level rise in the Chukchi Sea—Arctic insensitivity to global change?: *Global and Planetary Changes*, vol. 32, p. 13–23.

In this article, Mason and Jordan outline the apparent disconnect between late Holocene global sea level rise and the moderate sea level rise observed in Northwest Alaska. Radiocarbon ages taken from peat and storm deposits in Seward Peninsula lagoons allowed for the reconstruction of a sea-level curve spanning the last 6,000 years. The results indicate that sea level in Northwest Alaska has risen an average 0.3 mm per year compared to the global average of 1–2 mm per year. The authors suggest several hypotheses for these differing rates, including cold sea surface temperatures (limited steric expansion), geoid variation, and/or the development of permafrost. Although observed rates of sea level rise are moderate for the Chukchi Sea, the article cautions that the response of northern Alaska’s coasts to future global climate change remains uncertain and requires continued investigation.

Mofjeld, Harold O., February 1986, Observed tides on the northeastern Bering Sea Shelf: *Journal of Geophysical Research*, vol. 91, no. C2, p. 2593–2606

The author uses measurements from a bottom-pressure gauge array deployed between 1981 and 1982 on the Bering Sea shelf to examine the relationship between observed and modeled tidal fluctuations. The presented results include an improved identification of amphidromic node locations and a discussion of the influence of sea ice on tidal predictions in this region. The author emphasizes that considerable work is still necessary to account for spatial and seasonal departures of tidal observations from modeled predictions in this sparsely instrumented region.

Munter, James A., of Alaska Department of Natural Resources Division of Water, Alaska Hydrologic Survey, February 1994, Evaluation of ground water at a proposed wastewater disposal site, Gambell, Alaska: Alaska Division of Geological & Geophysical Surveys Public-Data File 94-28, 74 p.

The goals of this investigation were to identify ground-water flow systems and quality beneath the proposed lagoon site at Gambell, and determine the probable effect of the percolation lagoon on those systems. The

design may be susceptible to damage from the presence of highly permeable beach gravels throughout the area, irregular occurrences of permafrost, and storm-driven fluctuations in ground-water levels.

Nakao, Kinshiro, Kazuhisa Chikita, Shyu Nakaya, Koichi Urakami, and Yoshiyuki Ishii, February 1986, Palaeo-environment in St. Lawrence Island, Alaska: Journal of the Faculty of Science, Hokkaido University, ser. 7, vol. 8, no. 1, p. 15–27.

To validate hypotheses about ice sheet expansion in the northern hemisphere during Ice Ages, the authors collected quantitative paleorecords of precipitation and atmospheric temperatures from the sedimentary record on St. Lawrence Island. The objective of this study was to investigate the climatic effects of ocean-derived moisture during the construction of ice sheets. Sedimentary structures and permafrost base depths were inferred from electrical depth soundings at six sites and from two lake sediment cores (core logs are included in text). A chemical analysis of inland water and core sediments revealed the quantity and extent of salts derived from marine sources, showing spikes during the most recent marine transgressions.

Okleasik, Tom, of Northwest Planning and Grants Development for Community of Gambell and Kawerak—Community Economic Development, September 2003, Community strategic development plan for Gambell 2004–2009: Northwest Planning and Grants Development, Nome, Alaska, 48 p.

This is an extension and evaluation of the previous local economic development plan for Gambell, Alaska. These plans analyze local conditions, identify problems and opportunities, and develop goals, strategies, and outcomes to address community issues. Planning processes are based on methods developed by the Institute of Cultural Affairs, and the Denali Commission—USDA-RD—Alaska Humanities Forum Community Strategic Plan Guide and Form. The community development project priority related to coastal hazards has been identified as the construction of a boat harbor. The harbor would help to ensure safe landing for visitors, hunters, barges, fishermen, cruise ships, and would help to export mining and other products.

Oozeva, Conrad, Chester Noongwook, George Noongwook, Christina Alowa, and Igor Krupnik, 2004, Watching ice and weather our way—Sikumengllu eslamengllu esghapalleghput: Washington, D.C., Arctic Studies Center, National Museum of Natural History, Smithsonian Institution, and Savoonga Whaling Captains Association, 207 p.

This book was the result of a four-year partnership between Alaska Native hunters from two Yupik Eskimo communities on St. Lawrence Island, and sea ice experts. The authors documented and evaluated the changes noted by residents in order to observe environmental change using traditional ecological knowledge.

Included in the book are translations for 99 different types of sea ice with illustrated examples. There are also specific observations/stories of weather-related phenomena that include ice formation, hunting practices, and storms.

Overland, J.E., and A.T. Roach, June 1987, Northward flow in the Bering and Chukchi seas: Journal of Geophysical Research, vol. 92, no. C7, p. 7097–7105.

The Bering Strait is the only avenue for the exchange of ice, water, heat, and nutrients between the Pacific and Arctic Oceans. The authors use a two-dimensional, barotropic numerical model for the Bering Sea and Chukchi Sea shelves to investigate the relationship between sea levels and regional transport patterns. This provides additional evidence that Bering Strait transport and regional circulation patterns are driven by Pacific Ocean—Arctic Ocean sea level difference. The authors also use the model to qualitatively critique previous subregional observation-based studies.

Rodney P. Kinney Associates, Inc., and Kawerak Transportation Program, for Gambell IRA Council, March 2007, Gambell long-range transportation plan: Gambell IRA Council, Gambell, Alaska, indian reservation roads program no. E04167-GAMBELL, 15 p.

This report is a collaborative effort to evaluate the village road system, identify transportation needs, discuss alternatives, and prioritize projects for the transportation system for the City of Gambell, Alaska. The prioritized list of long term transportation road projects is as follows:

- 1. Construct proposed community streets in the City of Gambell (total estimated cost of \$26 million).*
- 2. Construct proposed subsistence and economic routes (total estimated cost of \$570 million).*

3. *Construct upgrades to marine facilities such as boat landings, harbors, ports, barge landings, and breakwater structures (total estimated cost \$7 million).*
4. *Provide route staking and navigational upgrades to inventory routes to improve safety during winter travel (\$100,000 per mile of road).*
5. *Construct shelter cabins at the end of the evacuation route (total estimated cost \$800,000).*

The list of inventory roads are completed for the needs of the next 20 years, and allow for the connection of communities, residential access to their lands and resources for economic growth, cultural development, subsistence activities, and enhancing public safety.

Simpson, J.J., January 1984, Final report, Task Force on Erosion Control: Alaska Department of Transportation & Public Facilities, project no. R-30023, 101 p.

The Erosion Control Task Force was appointed to investigate and inventory potential erosion problems on a statewide basis, to prioritize the erosion problem sites by severity and need, and to provide preliminary design plans where immediate remedial action is required. Sites were rated based on public safety, public property, private property, time of projected loss, ability to move, approximate replacement value, and economic value. Projected costs of erosion protection measures were analyzed, and totaled \$16,802,300 for all projects. This report outlines specific engineering projects to reduce the effects of coastal and riverine erosion for communities throughout Alaska.

Erosion at Gambell was documented as occurring at the sand point on the edge of the airport. Because of the steep sandy beach, a rock wall was not recommended. Instead the recommendation was made to monitor the rate of erosion for changes, and to push sand onto the beach off the taxiway after storm surges.

U.S. Army Corps of Engineers, accessed 2011, Civil works floodplain management services [website]: U.S. Army Corps of Engineers, Alaska District.

http://www.poa.usace.army.mil/en/cw/fld_haz/floodplain_index.htm

This website provides flood hazard data for communities throughout Alaska. A link is provided to a flood-hazard-specific bibliography, maintained by the U.S. Army Corps of Engineers. The last flood event for Gambell was reported in 1977. Typical storm surge conditions are included from resident reports. Gambell does not participate in the National Flood Insurance Program.

U.S. Army Corps of Engineers, March 2009, Study findings and technical report—Alaska baseline erosion assessment: Elmendorf Air Force Base, Alaska, U.S. Army Corps of Engineers, Alaska District, 68 p.

<http://www.poa.usace.army.mil/AKE/Home.html>

This statewide assessment was conducted by the U.S. Army Corps of Engineers to coordinate, plan, and prioritize responses to erosion throughout Alaska. The report has recognized Gambell as having erosion issues as well as being one of 69 communities where monitoring of conditions is taking place.

U.S. Government Accounting Office (GAO), 2003 [2004], Alaska Native villages—Most are affected by flooding and erosion, but few qualify for federal assistance: U.S. General Accounting Office Report GAO-04-142, 82 p.

<http://www.gao.gov/products/GAO-04-142>

This study was conducted to provide recommendations to Congress that would improve how state and federal agencies respond to flooding and erosion in Alaska. This was done by:

1. *Determining the extent to which these villages were affected.*
2. *Identifying federal and state flooding and erosion programs.*
3. *Determining the current status of efforts to respond to flooding and erosion in nine villages.*
4. *Identifying alternatives that Congress may wish to consider when providing assistance for flooding and erosion (see “Highlights” section).*

The recommendations provide alternatives to current actions taken during flooding and erosion responses by including federal agencies and the Denali Commission. The adoption of policies by the Denali Commission would guide investments in infrastructure for Alaska Native villages affected by flooding and erosion. Gambell was recognized as one of the 184 Alaska Native villages facing imminent flooding and erosion threats.

Waller, Roger M., October 1958, Water-resources reconnaissance of Gambell and Savoonga villages, St. Lawrence Island, Alaska: U.S. Geological Survey (USGS), 14 p.

This is part of a three-part report on groundwater conditions for rural Alaska villages. Gambell and Savoonga were visited in July and August 1957 to determine the possibility of securing a reliable groundwater supply.

Gambell is located on a gravel spit at the northwest end of St. Lawrence Island, about 35 ft amsl. Troutman Lake is a large body of fresh water 4 ft amsl, bounded by the gravel spit. The gravel spit contains loose, well-rounded, medium-coarse granitic sand and gravel. The material is mostly erosional from the Savoukuk Mountain, deposited outward by wave action. Permafrost has been reported at a depth of 22 feet below the ANS school, and a depth of 8 feet elsewhere.

Walton, F.W., R.B. Perry, and H.G. Greene, 1969, Seismic reflection profiles, northern Bering Sea: U.S. Department of Commerce Environmental Science Services Administration, operational data report C&GS DR-8, 17 p.

As part of a general continental shelf survey for Norton Sound, a series of seismic reflection profiles were collected aboard the USC&GSS SURVEYOR. The survey included bathymetric, gravity, and magnetic data at a 1 mile trackline spacing. This report contains the seismic trackline graphs along with the operations log for the cruise.

Wise, James L., Albert L. Comiskey, and Richard Becker, 1981, Storm surge climatology and forecasting in Alaska: Anchorage, Alaska, Arctic Environmental Information and Data Center, University of Alaska, 26 p.

The objective of this study was to improve the quality of life and the security of property in coastal areas susceptible to flooding by enhancing the decision-making process for human activities and development. This study compiles historical climatological data to develop a surge forecast regression equation. Four storms were documented for Gambell, occurring in 1946, 1969, 1972, and 1978.
