BEFORE THE PUBLIC UTILITY COMMISSION

OF OREGON

UM 1209

In the Matter of:	)	
MIDAMERICAN ENERGY HOLDINGS COMPANY	)	**KARUK TRIBE OF CALIFORNIA**
	)	**TESTIMONY OF LEAF HILLMAN**
Application for Authorization to Acquire Pacific Power & Light, dba PacifiCorp.	)	**TESTIMONY OF KARI NORGAARD**
	)	**TESTIMONY OF JACOB KANN**

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TESTIMONY OF LEAF HILLMAN

I, Leaf Hillman declare that if called upon to testify would testify as follows:

I am currently serving as Vice Chairman of the Tribal Council for the Karuk Tribe of California. I have been actively involved in the ecological concerns of the Klamath River for almost 20 years. In addition to holding a political position with the Tribe, I am a descendant of a prominent Karuk family who are ancestral owners of dance ceremonies associated with Pikyowish, the Karuk World Renewal Ceremonies. I serve as a World Renewal Priest and am charged with overseeing and coordinating ceremonies.

The ceremonies of my people are intertwined with the River which our prayers and dances center on. The fish of the Klamath River have sustained our physical and spiritual needs since time immemorial. In the last century, wanton disregard of the health of the River has caused severe and damaging impact upon our people. Shortsightedness has allowed the construction and continuing operation of five dams along the Klamath with little consequent thought to the inevitable impact on fish populations, or the affects upon the culture and way of life of the Indian people dependant thereon. After well over 20 years of struggle and effort by the affected tribes to correct this situation, not even the development or implementation of fish passage has been accomplished. It is a simple concept to grasp that Salmon need free river passage to survive as a species. PacifiCorp/Scottish Power, although having made commitments in the past to remedying this problem, has failed to meet their obligations to this end.

The upcoming FERC ordered improvements for relicensing of the hydropower facilities are infrastructure mandates and as such, would necessitate capital investment. This cost should not be born by the ratepayers, whether the ultimate owner is Scottish

Power, MEHC, or any other future purchaser. The public has lost enough in the passage of time and delay in correcting the 50+ years of damage caused by the Dams and their continued operation despite ecological impact on vulnerable aquatic species.

The year 2006 marks the end to a license which has contributed to the decimation of the water quality of the river and its resultant impact upon the fish, wildlife and people dependant upon its viability. PacifiCorp will necessarily be required to make substantial expenditures to obtain relicensing from FERC. The cost will be substantial and will require at minimum, several fish passage developments, and implementation of extensive water quality reparation programs. If these costs are ultimately prohibitive in terms of profitability, the cost of dam decommissioning will need to be considered and evaluated as a necessary alternative. This too is a costly project. Either outcome will substantially result in ratepayer impact if these costs are not determined and future cost allocation addressed as a condition to acquisition in this proceeding.

The Karuk Tribe requests that this Commission evaluate the impact of these costs and determines what portion should be covered by capital infrastructure funding and what portion will fall upon the Oregon Ratepayers. It is our concern that MECH has not considered the extent of these costs and has not identified future costs associated with the Klamath Dams. They certainly have not identified this as a planned infrastructure project to be paid with capital investment. The Klamath Project should be listed as a planned project with a specified estimated cost in the MECH Application. The multi-state "non- hydro" infrastructure projects must not be given priority status over the hydro infrastructure commitments MECH makes in Washington, California or Oregon. The other states involved in this acquisition likewise have an interest this future cost and to what extent it may deplete the shared infrastructure capital committed by MEHC.

As a cultural spokesperson for the Karuk People, we feel that the public has a real

interest in protecting not only the water quality and natural flow of the Klamath River necessary for the salmon's migration and survival, but also to preserve our ancient cultural traditions and the integrity of our natural homeland. Fishing as our historic way of life has been radically altered and this fact plays hard upon our souls as we witness our traditional ceremonial focus of prayer is decimated right at our doorsteps and ceremonial cites. Protection of the River and fish is protection of the Karuk People. The loss of culture is not only a loss for the Karuk people, but for all of us. As a community of people sharing the earth, we all suffer when a religion, language or culture is lost.

Cultural and dietary damages may be difficult to quantify economically, but these injuries cannot be discounted as interests unworthy of evaluation. If necessary corrections are not timely addressed to reduce toxic algae and the loss of salmon populations as a result of blocked migration passage and poor water quality, PacifiCorp may likewise be subjected to costly future civil litigation over these same concerns. This potential liability may likewise be of concern to Oregon ratepayers if these costs are borne by them by way of increased rates. Commitment of capital to the Klamath Project is the ratepayers' insurance that MECH is in a financial position to bear these costs with minimum impact on future rates.

Dated: November 18, 2005

____/s/ Leaf Hillman_____
LEAF HILLMAN
Karuk Tribal Council Vice Chairman

TESTIMONY OF KARI NORGAARD

I, Kari Norgaard declare that if called upon to testify would testify as follows:

The following is a brief overview of the key findings from my research and report entitled, "The Effect's of Altered Diet on the Health of the Karuk People", which is submitted on behalf of the Tribe. The full text of my report has been filed and served in PDF format in conjunction with this document. This testimony serves to direct the Commission's attention to the very real problem faced by the Karuk People as a result of the devastating effects that the operation of the PacifiCorp hydroelectric facilities has had and continues to have upon all aspects of Karuk life and health. These findings support the Tribe's position that mitigation and correction of these injuries will require substantial financial impact on PacifiCorp, whom ever the ultimate owner may be. The magnitude of these costs needs to be reasonable estimated and a commitment to some portion of capital investment by MEHC should be a mandatory condition for acquisition approval.

General Overview

- The diet of the Karuk people has shifted dramatically since European contact due to denied access to traditional foods. The dramatic decline in eel and salmon populations that once supplied over half the Karuk diet has occurred within the lifetime of most adults alive today.
- The loss of the most important food source, the Spring Chinook Salmon run, is directly linked to the appearance of epidemic rates of diabetes in Karuk families.
- The American Diabetes Association has recently calculated the annual cost of diabetes in the U.S. at $13,243 per person (ADA, 2003). Given this figure the annual direct cost of providing health care for the artificially high rate of diabetes for Karuk Tribal members is 1.9 million dollars. Per person indirect costs of diabetes in the form of lost workdays, permanent disability and premature death amount to an additional $5,729 per person per year.
- Total direct and indirect costs of diabetes for Karuk Tribal Members and descendants within the ancestral territory are $2.75 million annually. Any cost-benefit analysis of the dams on the Klamath River should include the 2.75 million annually in direct and indirect costs for the artificially high incidence of diabetes in the Karuk Tribe.
- The elimination of traditional foods including multiple runs of salmon, Pacific Lamprey, Sturgeon and other aquatic species has had extreme adverse health, social, economic, and spiritual effects on Karuk people.

- Prior to contact with Europeans and destruction of the fisheries the Karuk people were amongst the wealthiest in California. Today they are amongst the poorest: poverty and hunger rates are amongst the highest in the State and Nation. Median income for Karuk families is $13,000 and 88.4-91.9% of tribal members in Siskiyou County live below the poverty line. This dramatic reversal is directly linked to the destruction of the fisheries resource base.

- Environmental Justice laws require that federal agencies identify and address adverse affects to human health or the environment of their actions on minorities and low-income populations.

- Historic fish consumption for the Karuk Tribe is estimated at 450 pounds of salmon per person per year or 1.2 pounds per day. Estimates for 2004 are less than 5 pounds of salmon per person per year.

Health Effects of Denied Access to Traditional Foods

Traditional diet, especially salmon, is an important factor in both the prevention and treatment of diabetes. Traditional foods are higher in protein, iron, zinc, Omega 3 fatty acids and other minerals and lower in saturated fats and sugar.

- The estimated diabetes rate for the Karuk Tribe is 21%, nearly four times the U.S. average.

- The estimated rate of heart disease for the Karuk Tribe is 39.6%, three times the U.S. average.

- Diabetes is associated with severe and costly complications such as blindness, kidney failure, lower-extremity amputations and cardiovascular disease, disability, decreased quality of life and premature death that continue to affect American Indians disproportionately.

- The United Nations recognizes the right to food security and food sovereignty. Access to traditional food sources of salmon are a basic human right.

Cultural benefits of the use of traditional food include beliefs about food healthfulness and spiritual provisioning, economic benefits, and place in the social fabric of community life. A more detailed evaluation of these findings is contained in the report attached herewith.

It is requested that this Commission consider these findings as worthy of insuring that there will be financial commitment by MEHC to insure that all infrastructure improvements needed to remedy these problems as required by FERC be supported by MEHC commitment to capital investment and that the interests of the ratepayers be protected.

Dated: November 21, 2005

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KARI NORGAARD, PhD

KARI MARIE NORGAARD
CURRICULUM VITAE

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Evolution and Ecology
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EDUCATION

PhD	2003	Sociology, University of Oregon
MA.	1994	Sociology, Washington State University
BS	1992	Biology, Humboldt State University

POSTDOCTORAL RESEARCH

Social Dimensions of Invasive Species in the Klamath Mountains
University of California at Davis, IGERT Program in Biological Invasions (2003-2005)

DISSERTATION

Community, Place and Privilege: Double Realities, Denial and Climate Change in Norway.
Advisors: Sandra Morgen, John Foster, Jocelyn Hollander, Mia Tuan, Paul Slovic

MASTER'S THESIS

Compassion and the Circle of Respect: Making Sense of the Feminist and Environmental Movements.
Advisors: Lisa McIntyre, Noël Sturgeon, Loren Lutzenhiser, Val Jenness

AREAS OF SPECIALIZATION

Environmental sociology, feminist theory, race/class/gender, sociology of culture, sociology of emotions, social movements.

GRANTS AND AWARDS

2005 Distinguished Contribution to Sociological Practice, Pacific Sociological Association
2003 Marvin E. Olsen Graduate Student Paper Award for Environmental Sociology (awarded by the Environment and Technology Section of the ASA)
2002 Betty Foster McCue Scholarship
2002 General University Scholarship
2002 Ethnoracial Curriculum Integration Award
2000 American Scandinavian Foundation ($18,000)

2000 Fulbright Hays (declined)
2000 General University Scholarship, University of Oregon (declined)
2000 Research Support Grant, University of Oregon
2000 Sons of Norway Research Support Grant
2000 Travel Grant, Center for the Study of Women in Society
1999 General University Scholarship, University of Oregon

RESEARCH

March 2004 - October 2005	Consultant, Karuk Tribe of California
March 2003 - June 2005	Postdoctoral Researcher, U.C. Davis I.G.E.R.T. program on Biological Invasions.
August - November 2000	Visiting Researcher, Center for Environment and Development, University of Oslo, Norway
May - September 1996	Study design, research and write-up for socio-economic analysis of role of timber in economy of Siskiyou County, California.

TEACHING

August 2005 - present	Departments of Sociology and Environmental Studies, Whitman College
March 2003 - June 2005	Instructor, Biological Invasions IGERT Graduate Core Course, University of California at Davis
September - December 2001	Instructor, Sociology 451, Social Stratification, Department of Sociology, University of Oregon.
April 1999 - December 1999	Instructor: Sociology 304: Community, Environment and Society, Department of Sociology, University of Oregon.
June - August 1998	Instructor: Introduction to Cultural Ecology, The Sierra Institute, UC Santa Cruz Extension, Santa Cruz, California. A 15 unit field studies course co-taught in the Klamath Mountains of Northern California.
January 1996 - May 1996	Instructor: Sociology 102: Social Problems, College of the Siskiyous, Yreka California.
March 1996	Instructor, Introduction to Ecosystem Management, a "Jobs in the Woods" re-training at College of the Siskiyous, Yreka California.

September 1997 - 2002	Graduate Teaching Assistant, Department of Sociology, University of Oregon. Courses include: Introduction to Sociology, American Society, Sociology of Women, Race Relations, Research Methods, Social Movements, Sociology of the Family.
August 1992 - May 1993	Graduate Teaching Assistant, Department of Sociology, Washington State University. Courses include Demography, Human Ecology, Social Psychology.

PUBLICATIONS:

Norgaard, Kari. “People Want To Protect Themselves A Little Bit”, Emotions, Denial and Social Movement Non-Participation, The Case of Global Climate Change “Forthcoming in Sociological Inquiry”.

Kari Norgaard and Richard York, 2005 “Gender Equality and Nation State Environmentalism” Gender and Society Vol. 19 No. 4, 506-522.

Norgaard, Kari. 2003. “Denial Privilege and Global Environmental Justice: The Case of Climate Change,” Center for Environment and Development, University of Oslo.

Norgaard, Kari. 1999. “Moon Phases, Menstrual Cycles and Mother Earth: The Construction of a Special Relationship Between Women and Nature,@ Ethics and the Environment, Volume 4, Number 2.

Norgaard, Kari. 1998. "The Essentialism of Ecofeminism and the Real," Book Review Essay, Organization and Environment, Volume 11, Number 4.

Norgaard, Kari. "Explorations of Nature and Culture: Ecological Feminism and the Enrichment of Human Ecology," Advances in Human Ecology, Volume 5.

RESEARCH REPORTS:

The Effects of Altered Diet on the Health of the Karuk People Karuk Tribe of California, 2005

Learning from the Past: Timber and Economic Well-Being in Siskiyou County Klamath Forest Alliance, Etna, CA. 1996

Gender Equity and the Quality of Life. Riane Eisler, David Loye and Kari Norgaard. Center for Partnership Studies, Carmel, CA. 1995

WORK UNDER REVIEW:

Norgaard, Kari. 'We Don't Really Want to Know' The Social Experience of Global Warming: Dimensions of Denial and Environmental Justice" Revised and resubmitted to Organization and Environment.

Norgaard, Kari. "Weeds in the Eyes of the Beholder: Politics of Spotted Knapweed in California." Revised and resubmitted to Rural Sociology.

WORK IN PROGRESS

Denied Access to Traditional Tribal Management: Politics, River Ecology and Cultural Survival (with Amy Stercho) in preparation for Pacific Sociological Association Meetings

Cultural Norms of Time and Space: Global Warming and the Social Organization of Denial in preparation for Pacific Sociological Association Meetings

INVITED LECTURES

Hurricane Katrina and Environmental Justice, Whitman College September 2005

The Effects of Altered Diet on the Health of the Karuk People, Environmental Law Conference, Eugene Oregon, March 2005

"On Salmon and Tribes: The Deterioration of the Salmon Fishery and Health of a Northern Californian Tribe in the Klamath River Watershed" University of California Davis, June 2, 2005, web cast of event available at: http://johnmuir.ucdavis.edu/activities/salmon-n-tribes.html.

University of Edinburgh Panel Presentation: "The Cultural and Social Impacts of Dams on the Klamath River" July 20, 2005, Edinburgh, Scotland.

Ecological Conversations: Gender, Science and The Sacred, May 2002.

Learning From the Past: Timber and Economic Well-Being in Siskiyou County, Socioeconomic Scoping Workshop, Headwaters Environmental Center, January 23, 1998, Ashland, Oregon.

PRESENTATIONS AT PROFESSIONAL MEETINGS

Tools in the Toolbox: Community Based Stewardship in the Management of Invasive Weeds, California Invasive Plant Council, Ventura, CA October 2004

Privilege, Denial and the Construction of Innocence: Resources in the Cultural Tool Kit American Sociological Association, San Francisco, CA August 2004

"Herbicide Exposure and Cultural Sovereignty. Gender, Race and Class Dimensions of Environmental Justice in a Rural Community" Rural Sociology Society, Sacramento, California August 2004

Weeds" and The Eyes of the Beholders: Three Views on the 'Threat of Invasive Weeds' and What It All Says about Race and Social Structure in a Rural Community. American Society for Environmental History, Houston TX 2004

Community Responses to Spotted Knapweed: A Sociological View California Invasive Plant Council, Lake Tahoe, CA October 2003

People Want To Protect Themselves A Little Bit" Emotions, Denial and Social Movement Non-Participation The Case of Global Climate Change. American Sociological Association Atlanta, GA August 2003

Denial Privilege and Global Environmental Justice: The Case of Climate Change, American Sociological Association Atlanta, GA August 2003

Gender Equality and Nation State Environmentalism (with Richard York) Pacific Sociological Association, Pasadena, CA April 2003.

Experiencing Global Warming: The Social Organization of Awareness, Denial and Innocence, International Sociological Association, Brisbane, Australia, July 2002.

Experiencing Global Warming: The Social Organization of Awareness, Denial and Innocence, Pacific Sociological Association, Vancouver, British Columbia, April 2002.

Moon Phases, Menstrual Cycles and Mother Earth: The Construction of a Special Relationship Between Women and Nature, Pacific Sociological Association, San Diego, California, April, 2000.

Relationships, Meaning and Community Ecology: An Ecofeminist Concern, North American Conference on Community and Environment, February 12, 1999, Ogden, Utah.

Problems in Ecofeminist Research Design, Ecofeminist Philosophy Conference, March 4, 1998, Missoula, Montana

Compassion and the Circle of Respect, Pacific Sociological Association, March 1998, San Francisco, California.

PROFESSIONAL ACTIVITIES

Member, Membership Committee, Pacific Sociological Association (2003-present)

Co-Director and Founding Member, Feminist Social Sciences Networking Research Interest Group, Center for the Study of Women in Society (2000-2002).

Member, Women and Environment Research Interest Group, Ecological Conversations Project, Center for the Study of Women in Society (1996-2002).

Book Review Editor, Organization and Environment (1999-2000)

Graduate Student Representative to Sociology Faculty (1999-2000)

RESEARCH IN THE NEWS

Research the Topic of Story: National Public Radio All Things Considered: "California Tribe Fights Back" March 17, 2005
Tribe Fights Dams to Get Diet Back January 30 Washington Post Page A1
Radio Interview Jefferson Public Radio, March 2005
Radio Interview KHSU, Eco News March 2005

LANGUAGE COMPETENCIES

Norwegian	fluent
Spanish	unpolished conversational

MEMBERSHIPS IN PROFESSIONAL ORGANIZATIONS

American Sociological Association
Pacific Sociological Association
Society for Applied Sociology

REFERENCES

Dr. Sandra Morgen
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TESTIMONY OF JACOB KANN

Technical Memorandum: Toxic Cyanobacteria in Copco and Iron Gate Reservoirs

The purpose of this memorandum is to provide a brief summary of toxic cyanobacteria events occurring in Copco and Iron Gate Reservoirs during September of 2004 and July-November of 2005.

A toxic bloom of *Microcystis aeruginosa* (MSAE) was first documented in Copco Reservoir on September 29th 2004 when 1.9 million cells/ml of MSAE were associated with a microcystin toxin concentration of 482 µg/L. Cell density achieved on 9-29-04 exceeded the World Health Organization (WHO) Level for Moderate Probability of Adverse Health Effects (MPAHEL; Falconer et al. 1999) by ~19 times. Microcystin is a potent hepatotoxin capable of causing chronic liver damage and acting as a tumor promoter, and the microcystin toxin concentration was 66 times greater than the Tolerable Daily Intake (TDI: 0.04 µg kg bw^{-1} WHO 1998) for a 40 lb [18kg] child accidentally ingesting 100 mls of reservoir water on that date; Table 1). Children are more susceptible to toxins than are adults due to their smaller body size and greater potential for accidental ingestion.

During the 2005 sampling season both cell density and toxin samples were collected from a variety of shoreline and open-water sites, including the standard open-water locations: IR01 and CR01 (Fig. 1a). Stations IR01, IR03, and CR01 are open-water locations and were sampled biweekly as part of an EPA/SWRCB funded nutrient loading study. Other stations were sampled specifically to assess the extent of toxic cyanobacteria (Fig. 1a). The stations KRAC and KRBI are Klamath River stations above Copco (KRAC) and Below Iron Gate (KRBI). One additional sample was collected by the Klamath Tribes at the outlet of Upper Klamath Lake (UKLOUT) on Sep 9th (Fig 1b).

Shoreline samples consist of grab samples of surface algal material, and open-water samples consist of a surface or 1 m grab taken with a Van-Dorn water collection bottle. Samples for phytoplankton density and biovolume are preserved in Lugol's Iodine and are sent to Aquatic Analysts in White Salmon, WA. Samples for determination of microcystin toxin are placed in a cooler with gel-ice and shipped overnight air to Wright State University in Dayton, OH. Specific data and laboratory reports were summarized in a series of Tech Memos and are available form the Karuk Department of Natural Resources.

Cell density and toxin concentration were compared to MPAHEL thresholds for recreational waters as published in documents for the World Health Organization (WHO) and EPA (Falconer el al. 1999; Chorus and Cavalieri 2000). The MPAEL is 100,000 cells/ml or 20 µg/L microcystin in the top 4 meters of surface waters and the TDI is as described in Table 1. The WHO (Falconer et al. 1999) further lists cyanobacterial scums in swimming areas as having the potential to cause acute poisoning and recommends immediate action to prevent contact with scums.

The first visual indication of a cyanobacterial bloom in the reservoir system in 2005 occurred on July 13th and subsequent analyses showed >11 million MSAE cells per ml and 667 µg/L of microcystin at station CRSH (Table 1). Toxigenic blooms then continued through early November with the typical bloom appearance shown in Fig. 2. A summary of cell density data shows a preponderance of reservoir stations exceeding the WHO MPAHEL of 100,000 cells/ml for the majority of the Aug-Oct period (Fig. 3). During the peak cell density period of mid Aug to mid Sep several stations exceeded this level by more than 100x, with the maximum cell count at 163 million cells/ml (>1000x the MPAHEL) on 9/20 (Fig. 3). No MSAE was detected in the Klamath River inflow to Copco on any of the measured sample dates (Fig 3: station KRAC; red circles). However, a maximum of 42,577 cells/ml of MSAE was detected in the Klamath River below Iron Gate on 9/8 (KRBI; Table 1, Fig. 3).

Microcystin toxin levels followed the general seasonal trend of cell counts, peaking in September and declining in October (Fig. 4). During the August-September period toxin levels exceeded the MPHAEL of 20 µg/L at the majority of stations, and levels were frequently greater than 10x the MPHAEL, peaking at 1994 µg/L at CRCC on 9/20 (Table 1; Fig. 4). Likewise, the TDI was commonly exceeded by more than 10-100x throughout the August-September period (Table 1; Fig. 5). The toxin analysis for the sample collected at the outflow of Upper Klamath Lake (UKLOUT) on 9/8 shows a low microcystin toxin level of 0.32 µg/L (Table 1; blue triangle Fig. 4) and subsequent analyses at KRAC shows that microcystin was not detected at this location (red circles; Fig. 4).

For the sampled dates both cell density and toxin data indicate that neither toxin nor MSAE cells were detectable in the Klamath River directly above the reservoirs in 2005. During the same sample dates when in-reservoir data (the boxes in Figs. 3 and 4) showed substantial MSAE cell density and toxin concentration, the station KRAC had non-detects for both parameters (red circles in Figs. 3 and 4). Although periodic concentrations of MSAE are known to occur in Upper Klamath Lake (UKL), less than 1µg/L of microcystin was detected at UKLOUT on 9/9. On this same date Copco and Iron Gate reservoir stations exhibited substantial microcystin concentrations that were 100's of times higher than the concentration at the outlet of UKL (Fig. 4).

These data are consistent with literature showing that MSAE and other buoyant cyanobacteria do not dominate in conditions of turbulent mixing such as that known to occur in the Klamath River above Copco and Iron Gate Reservoirs. For example, Huisman et al. (2004) demonstrate that potentially toxic MSAE dominate at low turbulent diffusivity (calm-stable conditions) when their flotation velocity exceeds the rate of turbulent mixing. Such conditions are more likely to occur in lakes and reservoirs as velocity and turbulence are reduced. The non-detects at KRAC (above Copco reservoir) even when reservoir stations show substantial concentrations of both toxin and MSAE cell density, clearly indicate the role of the reservoirs in providing ideal habitat conditions for MSAE. Moreover, as indicated by cell count and toxin data at KRBI (below Iron Gate Dam), the potential exists for export of both cells and toxin to downstream environments. In areas where turbulent diffusivity may decrease as the river widens or such as would in backwater areas, the potential exists for high concentrations to occur downstream. In fact, MSAE cell concentration exceeded 1.3 million cells/ml in a backwater area near the confluence of Coon Creek nearly 100 miles downstream from Iron Gate Dam (written communication Yurok Tribe).

Due to the patchy nature of blue-green algal blooms it is possible for higher *Microcystis aeruginosa* densities (and therefore higher microcystin toxin concentrations) to be present in other locations,

particularly along shorelines or protected coves and backwaters during calm conditions of little to no wind. Recreational users should always avoid contact with water whenever noticeable surface concentrations of algae are evident. Moreover, because pets or other domestic animals are the most likely to ingest contaminated water, these animals should not be allowed access to areas of either noticeable surface concentrations of algae or when an obvious green to blue-green appearance is evident.

Literature Cited

Chorus, I, and M. Cavalieri. 2000. Cyanobacteria and algae. Pages 219-271 *in*: J. Bartram and G Rees, editors. *Monitoring Bathing Waters: a practical guide to the design and implementation of assessments and monitoring programmes.* World Health Organization Report. E & FN Spon, London and New York.

Falconer et al. 1999. Safe levels and safe practices. Pages 155-177 *in*: I. Chorus and J. Bartram, editors. *Toxic Cyanobacteria in water: a guide to their public health consequences*. World Health Organization Report. E & FN Spon, London and New York.

Huisman, J. et al. 2004. Changes in turbulent mixing shift competition for light between phytoplankton species. Ecology 85(11): 2960-2970.

WHO 1998. Guidelines for Drinking-water Quality. Second Ed. Addendum to Vol. 2, Health Criteria and Other Supporting Information. World Health Organization, Geneva.

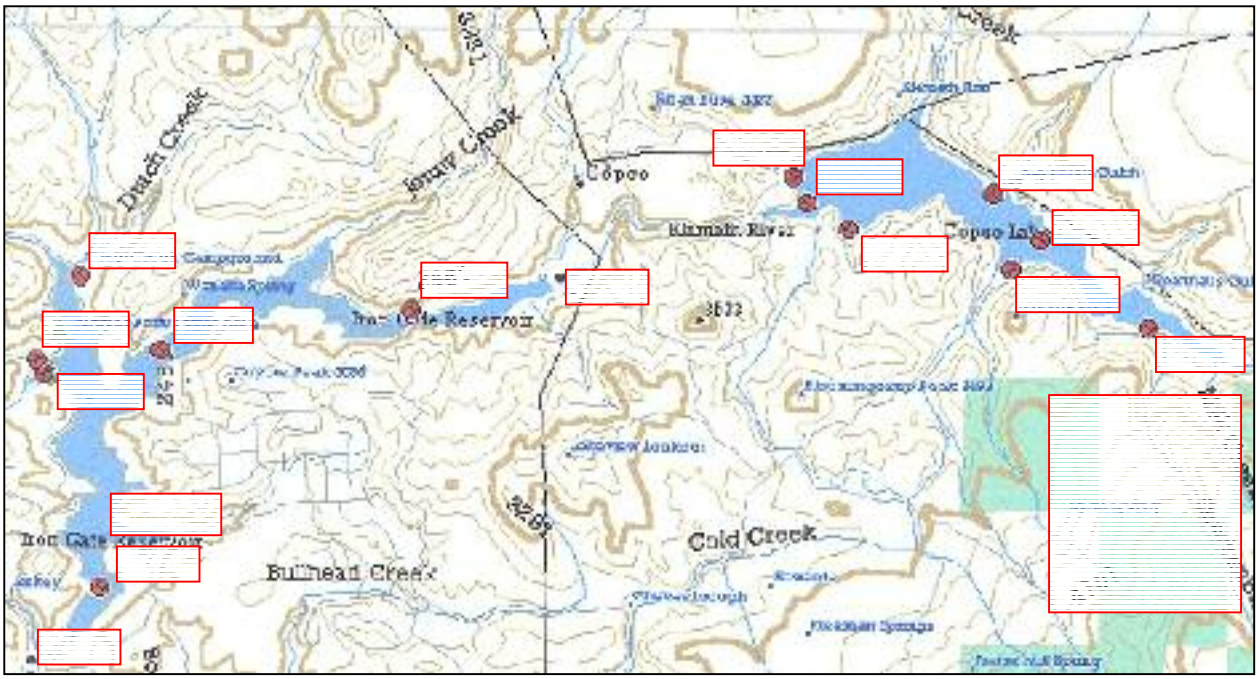

Figure 1a. Location of Copco and Irongate Reservoir toxic cyanobacteria sampling stations, 2005.

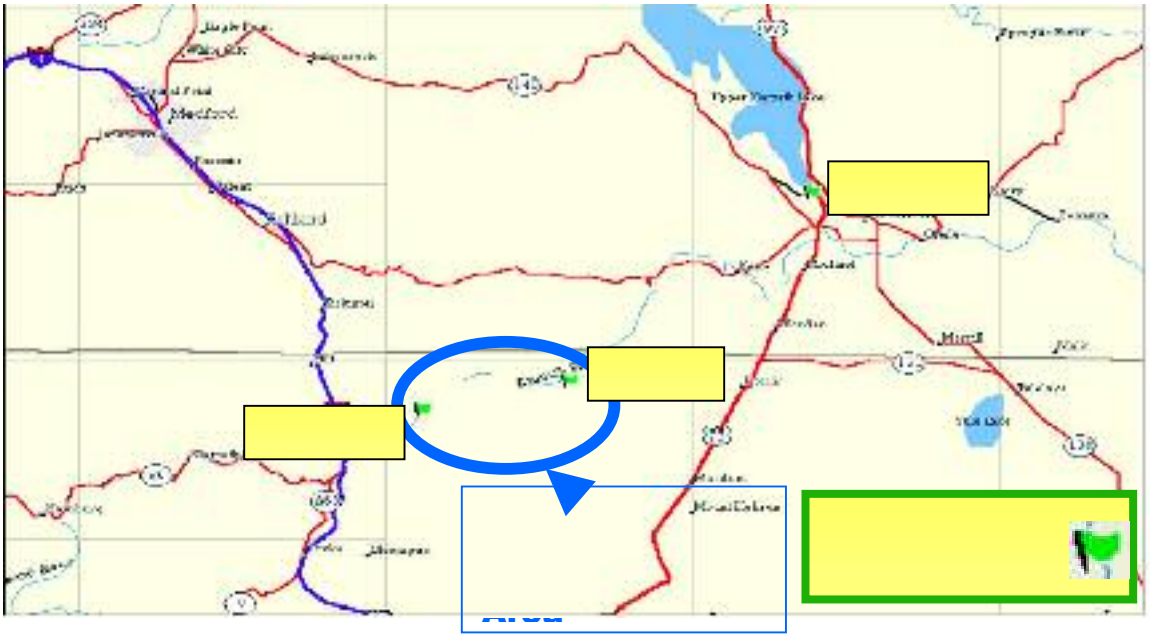

Figure 1b. Location of Klamath River sampling stations, 2005.

Table 1. Cell density and risk exceedance for toxigenic cyanobacteria in Copco and Irongate Reservoirs, 2005.

DATE	STATION LAT/LON	STATION NAME	DEPTH	*Microcystis aeruginosa* (cells/ml)	*Anabaena flos-aquae* (cells/ml)	Microcystin Total (μg/L)	Microcystin Aqueous Phase (μg/L)	Exceedance of moderate risk level of 100,000 cells/ml *Microcystis* (x greater than 10^5 cells/ml)	Exceedance of moderate risk level of 20 μg/L microcystin (x greater than 20 μg/L)	Exceedance of TDI of 0.04 μg/kg/day for a 40 lb (18kg) child ingesting 100 mls (x greater than TDI)
9/29/04	N41 58.705 W122 19.301	CRJS	0	1,908,732	0	482.00		19	24	67
6/28/05	N41 56.330 W122 25.930	IR01	1	793	2,213			0		
6/28/05	N41 57.876 W122 25.389	IR03	1	0	541			0		
6/29/05	N41 58.932 W122 19.694	CR01	1	0	181			0		
6/29/05	N41 58.796 W122 17.796	CR02	1	0	0			0		
7/13/05	N41 58.932 W122 19.694	CR01	0	15,527	488			0		
7/13/05	N41 58.932 W122 19.694	CR01	1	0	0			0		
7/13/05	N41 58.932 W122 19.694	CR01-D	0	15,987	0			0		
7/13/05	N41 58.796 W122 17.796	CR02	1	0	0			0		
7/13/05	N41 58.939 W122 18.032	CRSH	0	11,402,943	38,383	667.00		114	33	92
7/14/05	N41 56.330 W122 25.930	IR01	1	0	0			0		
7/14/05	N41 57.876 W122 25.389	IR03	1	0	203			0		
7/26/05	N41 58.932 W122 19.694	CR01	0	0	0			0		
7/26/05	N41 58.932 W122 19.694	CR01	1	278	0			0		
7/26/05	N41 58.796 W122 17.796	CR02	1	0	145			0		
7/26/05	N41 59.035 W122 19.802	CRCC	0	3,316,176	0	72.16	0.31	33	3.6	10.0
7/27/05	N41 56.330 W122 25.930	IR01	1	0	0			0		
7/27/05	N41 57.876 W122 25.389	IR03	0	5,534	1,217	0.92		0	0.05	0.13
7/27/05	N41 57.876 W122 25.389	IR03	1	223	0			0		
7/27/05	N41 58.161 W122 23.176	IRSH	0	NA	NA	98.38	31.6	NA	5	14
8/10/05	N41 58.345 W122 12.101	KRAC	0	0	0					
8/10/05	N41 58.932 W122 19.694	CR01	0	151,004	0	90.35		2	4.5	12.5
8/10/05	N41 59.035 W122 19.802	CRCC	0	283,963	0	196.36		3	9.8	27.1
8/10/05	N41 58.441 W122 17.869	CRMC	0	1,427,215	0	36.58		14	1.8	5.1
8/10/05	N41 58.067 W122 16.648	CRSS	0	1,985,035	0	44.22		20	2.2	6.1
8/11/05	N41 56.330 W122 25.930	IR01	0	916,548	0	16.23		9	0.8	2.2
8/11/05	N41 58.368 W122 26.114	IRCC	0	1,423,430	0	14.23		14	0.7	2.0

DATE	STATION LAT/LON	STATION NAME	DEPTH	*Microcystis aeruginosa* (cells/ml)	*Anabaena flos-aquae* (cells/ml)	Microcystin Total (μg/L)	Microcystin Aqueous Phase (μg/L)	Exceedance of moderate risk level of 100,000 cells/ml *Microcystis* (x greater than 10^5 cells/ml)	Exceedance of moderate risk level of 20 μg/L microcystin (x greater than 20 μg/L)	Exceedance of TDI of 0.04 μg/kg/day for a 40 lb (18kg) child ingesting 100 mls (x greater than TDI)
8/11/05	N41 57.721 W122 26.425	IRJW	0	4,059,000	0	46.55		41	2.3	6.4
8/11/05	N41 57.810 W122 26.493	IRNC	0	5,350,847	0	46.02		54	2.3	6.4
8/11/05	N41 55.865 W122 26.532	KRBI	0	989	0			0		
8/24/05	N41 58.345 W122 12.101	KRAC	0	0	0			0		
8/24/05	N41 59.035 W122 19.802	CRCC	0	6,413,303	0	640.20		64	32.0	88.4
8/24/05	N41 58.441 W122 17.869	CRMC	0	9,826	0	1.40		0	0.1	0.2
8/24/05	N41 58.067 W122 16.648	CRSS	0	46,834,615	0	1571.70		468	78.6	217.1
8/24/05	N41 58.932 W122 19.694	CR01	0	28,188	0	8.00		0	0.4	1.1
8/25/05	N41 56.330 W122 25.930	IR01	0	528,759	0	645.40		5	32.3	89.1
8/25/05	N41 58.368 W122 26.114	IGCC	0	1,251,525	0	93.60		13	4.7	12.9
8/25/05	N41 58.368 W122 26.114	IGCC-D	0	1,164,467	0	94.60		12	4.7	13.1
8/25/05	N41 57.721 W122 26.425	IGJW	0	17,458,065	0	632.20		175	31.6	87.3
8/25/05	N41 56.395 W122 25.504	IGOW	0	8,944,366	0	436.90		89	21.8	60.3
8/25/05	N41 55.865 W122 26.532	KRBI	0	24,429	0					
9/7/05	N41 58.345 W122 12.101	KRAC	0	0	0			0		
9/7/05	N41 59.035 W122 19.802	CRCC	0	10,022,222	0	946.00		100	47.3	130.7
9/7/05	N41 58.441 W122 17.869	CRMC	0	737,617	0	50.00		7	2.5	6.9
9/7/05	N41 58.067 W122 16.648	CRSS	0	24,415,038	0	321.48		244	16.1	44.4
9/7/05	N41 58.932 W122 19.694	CR01	0	1,252,778	0	75.05		13	3.8	10.4
9/8/05	N41 56.330 W122 25.930	IR01	0	3,095,098	0	9.41		31	0.5	1.3
9/8/05	N41 57.876 W122 25.389	IR03	0	2,307,442	0	431.14		23	21.6	59.5
9/8/05	N41 58.368 W122 26.114	IGCC	0	33,407	0	10.78		0	0.5	1.5
9/8/05	N41 57.721 W122 26.425	IGJW	0	584,473	0	100.86		6	5.0	13.9
9/8/05	N41 55.865 W122 26.532	KRBI	0	42,577	0			0		
9/8/05		UKLOUT	0			0.32			0.0	0.0
9/20/05	N41 58.345 W122 12.101	KRAC	0	0	0			0		
9/20/05	N41 59.035 W122 19.802	CRCC	0	163,004,286	0	1994.83		1,630	99.7	275.5
9/20/05	N41 58.441 W122 17.869	CRMC	0	2,931,500	0	1856.54		29	92.8	256.4

DATE	STATION LAT/LON	STATION NAME	DEPTH	*Microcystis aeruginosa* (cells/ml)	*Anabaena flos-aquae* (cells/ml)	Microcystin Total (μg/L)	Microcystin Aqueous Phase (μg/L)	Exceedance of moderate risk level of 100,000 cells/ml *Microcystis* (x greater than 10^5 cells/ml)	Exceedance of moderate risk level of 20 μg/L microcystin (x greater than 20 μg/L)	Exceedance of TDI of 0.04 μg/kg/day for a 40 lb (18kg) child ingesting 100 mls (x greater than TDI)
9/20/05	N41 58.067 W122 16.648	CRSS	0	5,965,608	0	227.39		60	11.4	31.4
9/21/05	N41 58.932 W122 19.694	CR01	0	46,256	0	3.08		0	0.2	0.4
9/21/05	N41 56.330 W122 25.930	IR01	0	4,920,000	0	141.23		49	7.1	19.5
9/20/05	N41 58.368 W122 26.114	IGCC	0	33,995	0	2.64		0	0.1	0.4
9/20/05	N41 57.721 W122 26.425	IGJW	0	6,657	0	142.31		0	7.1	19.7
9/20/05	N41 55.865 W122 26.532	KRBI	0	8,509	0	1.27		0	0	0
10/4/05	N41 58.345 W122 12.101	KRAC	0	0	0	0.00		0	0.0	0.0
10/4/05	N41 59.035 W122 19.802	CRCC	0	28,544	0	9.29		0	0.5	1.3
10/4/05	N41 58 22.4 W122 21 518	KRAI	0			0.85			0.0	0.1
10/4/05	N41 58.932 W122 19.694	CR01	0	22,284,026	0	37.65		223	1.9	5.2
10/5/05	N41 56.330 W122 25.930	IR01	0	68,480	0	0.87		1	0.0	0.1
10/5/05	N41 56.330 W122 25.930	IR01-D	0			0.49			0.0	0.1
10/5/05	N41 58.368 W122 26.114	IR03	0	18,982	0			0		
10/5/05	N41 57.721 W122 26.425	IGJW	0	88,617	0	5.92		1	0.3	0.8
10/5/05	N41 55.865 W122 26.532	KRBI	0	0	0	0.24		0	0	0
10/18/05	N41 58.345 W122 12.101	KRAC	0	0	0	0.00		0	0.0	0.0
10/18/05	N41 59.035 W122 19.802	CRCC	0	953,620	0	3.23		10	0.2	0.4
10/18/05	N41 58.932 W122 19.694	CR01	0	1,986,548	0	1.25		20	0.1	0.2
10/18/05	N41 58.932 W122 19.694	CR01-D	0	1,621,162	0	1.12		16	0.1	0.2
10/18/05		KRAI	0			0.00			0.0	0.0
10/19/05	N41 56.330 W122 25.930	IR01	0	16,155,224	0	3.44		162	0.2	0.5
10/19/05	N41 56.330 W122 25.930	IR01-D	0	12,712,563	0	8.18		127	0.4	1.1
10/19/05	N41 57.721 W122 26.425	IGJW	0	980	0	0.00		0	0.0	0.0
10/19/05	N41 58.157 W122 23.074	IRUS	0	8,768,503	0			88		
10/19/05	N41 55.865 W122 26.532	KRBI	0	58	0	0.00		0		
10/26/05	N41 58.157 W122 23.074	IRUS	0	22,241,096	0	5.99		222	0.3	0.8
10/26/05	N41 58.157 W122 23.074	IRUS-D	0	12,596,111	0			126.0		
11/2/05	N41 58.345 W122 12.101	KRAC	0	0	0			0	0.0	0.0

DATE	STATION LAT/LON	STATION NAME	DEPTH	*Microcystis aeruginosa* (cells/ml)	*Anabaena flos-aquae* (cells/ml)	Microcystin Total (μg/L)	Microcystin Aqueous Phase (μg/L)	Exceedance of moderate risk level of 100,000 cells/ml *Microcystis* (x greater than 10^5 cells/ml)	Exceedance of moderate risk level of 20 μg/L microcystin (x greater than 20 μg/L)	Exceedance of TDI of 0.04 μg/kg/day for a 40 lb (18kg) child ingesting 100 mls (x greater than TDI)
11/2/05	N41 59.035 W122 19.802	CRCC	0	6,505	0			0	0.0	0.0
11/2/05	N41 58.932 W122 19.694	CR01	0	0	0			0	0.0	0.0
11/3/05	N41 56.330 W122 25.930	IR01	0	867	0			0	0.0	0.0
11/3/05	N41 56.330 W122 25.930	IR01-D	0	0	0			0	0.0	0.0
11/2/05	N41 55.865 W122 26.532	KRBI	0	0	0			0		

CRSS 24,415,038 cells/ml

CRMC; 737,617cells/ml

CRCC; 10,022,222 cells/ml

IR03; 2,307,442 cells/ml

Figure 2. Typical appearance of *Microcystis aeruginosa* blooms and corresponding cell density in Copco and Irongate Reservoirs (September 7-8, 2005).

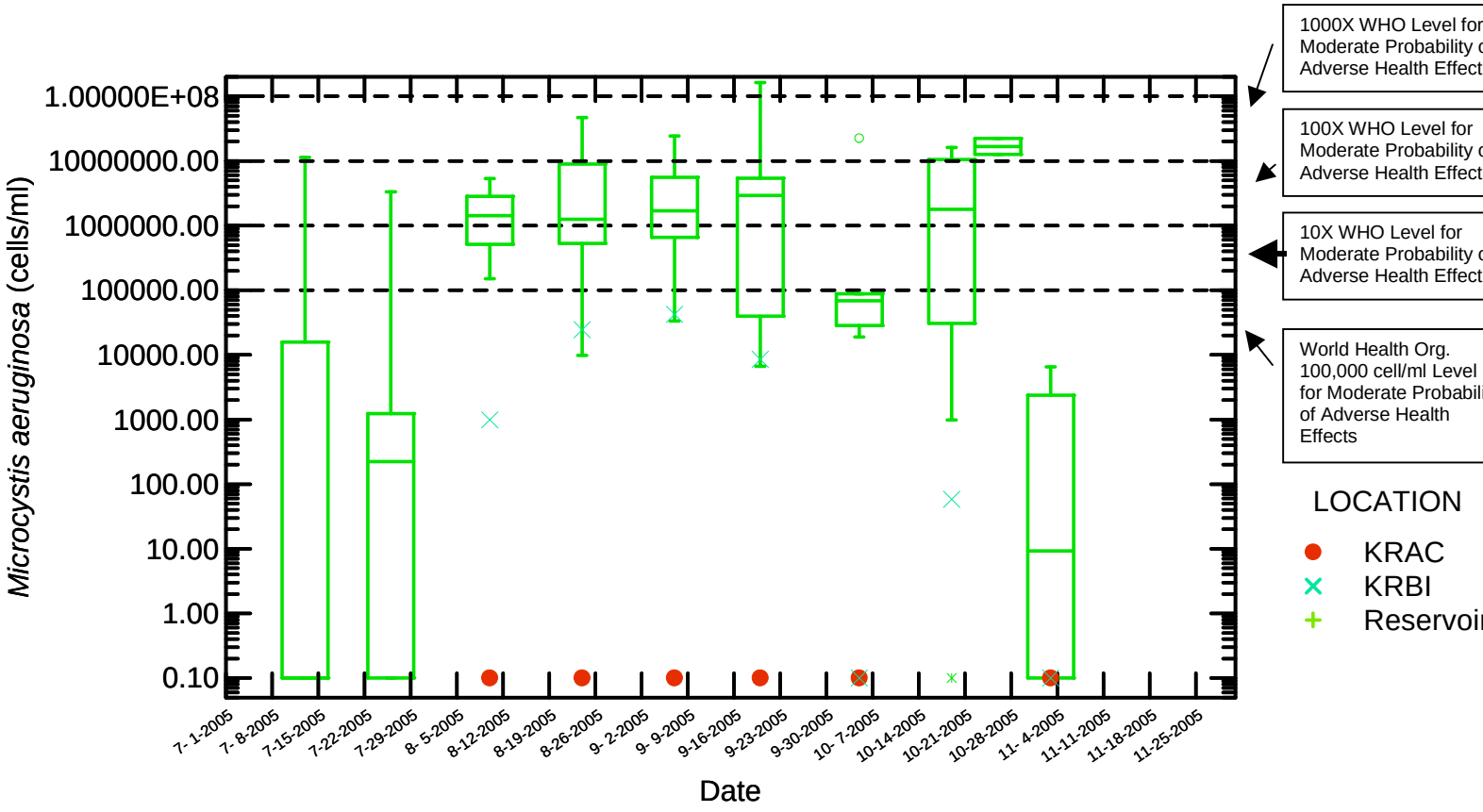

Figure 3. *Microcystis aeruginosa* cell density in Copco and Irongate Reservoirs, July-October, 2005. Note y-axis is log scaled; Reservoirs=Copco and Iron Gate., KRAC=Klamath R. above Copco Res., KRBI=Klamath R. below Iron Gate Res.

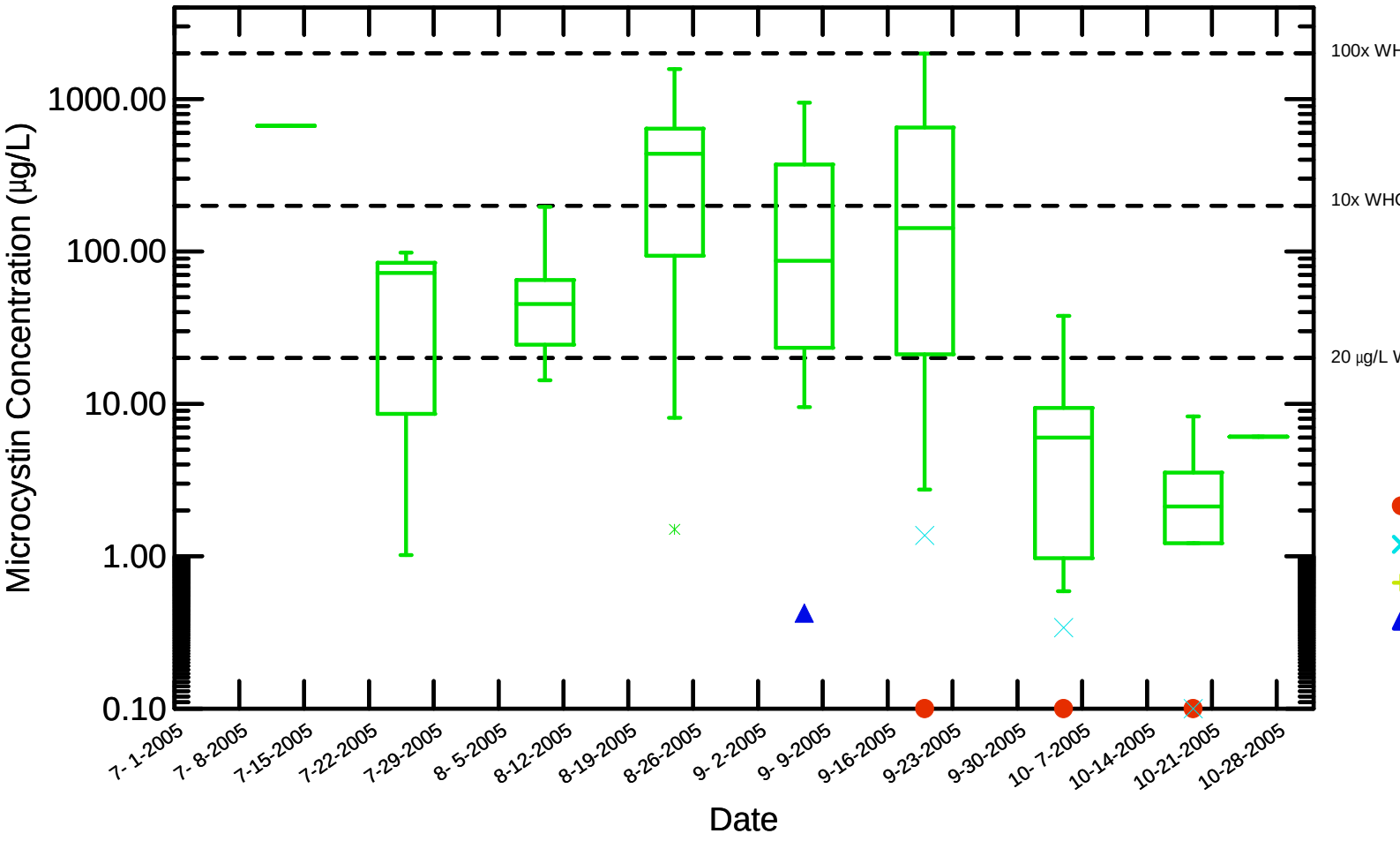

Figure 4. Microcystin concentration in Copco and Irongate Reservoirs, July-October, 2005. Note y-axis is log scaled; Reservoirs=Copco and Iron Gate., KRAC=Klamath R. above Copco Res., KRBI=Klamath R. below Iron Gate Res; UKLOUT=outflow from Upper Klamath Lake at Freemont Bridge.

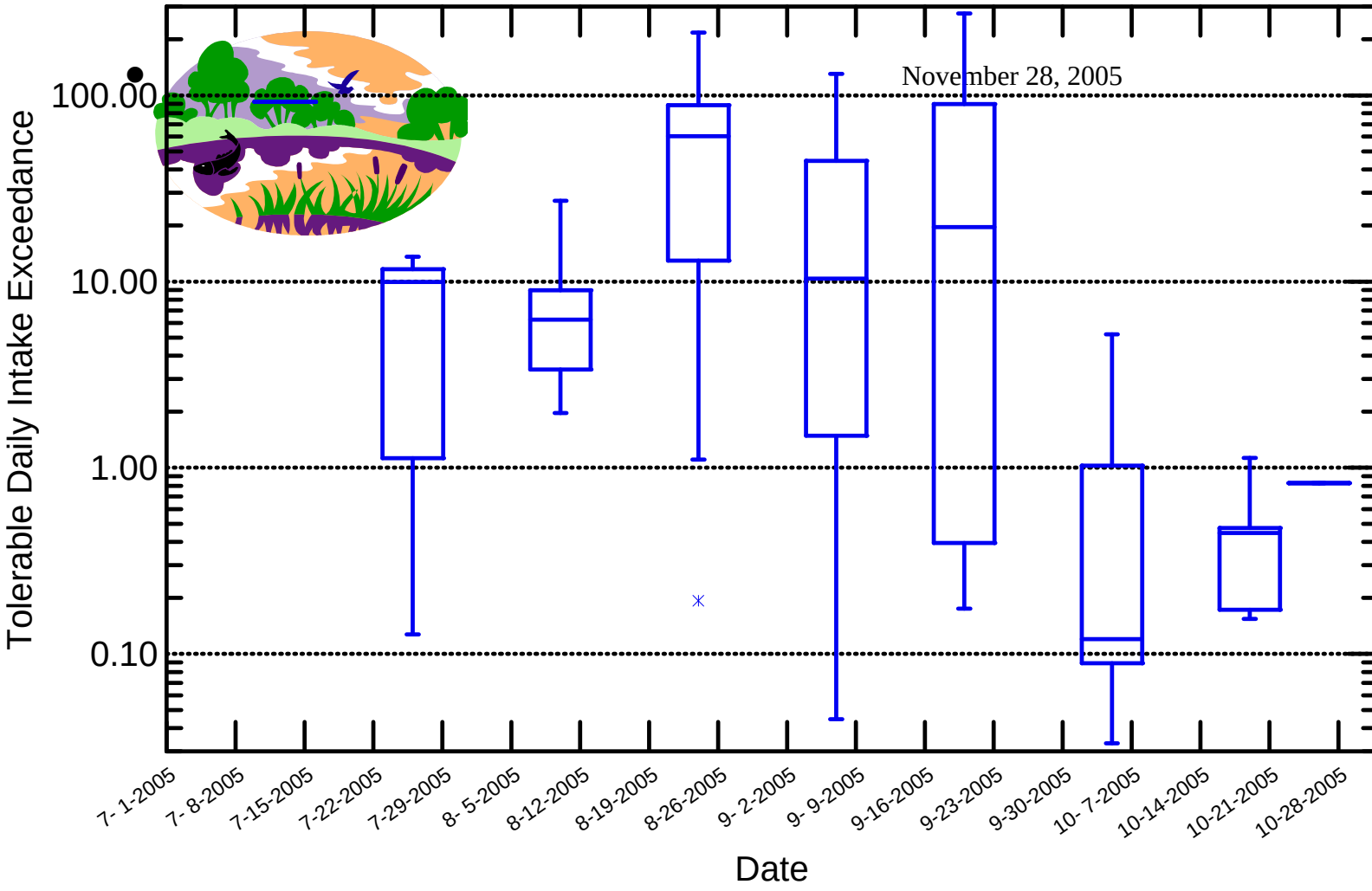

Figure 5. Tolerable Daily Intake (TDI) Exceedance (x greater than TDI) in Copco and Irongate Reservoirs, July-October, 2005. Exceedance based on TDI of 0.04 µg/kg/day for a 40 lb (18kg) child ingesting 100 mls of reservoir water. Note y-axis is log scaled.

CURRICULUM VITAE

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EDUCATION

B.A., ECOLOGY	1983	Rutgers University, Rutgers College Department of Biological Sciences, New Brunswick, New Jersey 08901
M.S., FISHERIES RESOURCES	1987	University of Idaho. Department of Fish and Wildlife Resources Moscow, Idaho 83843.
Ph.D., AQUATIC ECOLOGY	1998	University of North Carolina Curriculum in Ecology Chapel Hill, North Carolina 27599.

AREAS of SPECIALIZATION

- Ecological research (field and laboratory) pertaining to limnological, fisheries, wetland, and watershed dynamics.
- Ecology and dynamics of toxic algal blooms.
- Integration of water quality and hydrologic factors with fisheries ecology and management.
- Lake and reservoir restoration and management
- Trophic dynamics
- Ecosystem restoration projects
- Limnological investigations with special emphasis on water quality, nutrient dynamics, and

eutrophication
• Statistical analysis and modeling.

CURRENT POSITION

CONSULTING AQUATIC ECOLOGIST 295 E. Main St, Ste 7, Ashland, Oregon, 97520.
AQUATIC ECOSYSTEM SCIENCES LLC. Principal in firm conducting research and providing expertise in aquatic ecology, fisheries, and water quality.
Environmental Sciences Graduate Program Faculty, Oregon State University, Corvallis, Oregon, 97331.

Recent and Current Clients:
- California Water Board/Karuk Tribe – Nutrient Loading to Klamath River Reservoirs
- Oregon Human Services – Review Algal Monitoring and Threshold Guidelines
- Josephine County Parks Dept. – Toxic algal blooms in Lake Selmac
- US Forest Service Umpqua NF – Assessment of Diamond Lake, Oregon Toxic Algal Blooms
- City of Lakeside Oregon and Tenmile Lakes Basin Partnership – Toxic Algal Blooms in Tenmile Lakes, OR
- US Environmental Protection Agency – Klamath and Lost River TMDL Planning
- Kier Associates/Klamath Basin Tribal Water Quality Work Group- Klamath River, CA water quality assessment.
- Oregon Dept. of Environmental Quality/JC Headwaters – Diamond Lake TMDL analysis and modeling.
- Betts, Patterson and Mines/City of Lakewood – Limnological Data Assessment, Steilacoom Lake, Washington
- Klamath Basin Rangeland Trust – Water Quality and Fisheries Monitoring in the Wood River Valley Oregon.
- Oregon Department of Fish and Wildlife – Assessment of Diamond Lake Restoration Options
- US Fish and Wildlife Service/Graham Matthews and Associates – Water Quality in Stream Restoration Projects Tributary to Klamath Lake.
- Jim Root Crooked Creek Ranch – Aquatic Habitat Restoration and Monitoring.
- Klamath Tribes Natural Resources – Nutrient Loading and Water Quality Research in Streams and Lakes of the Klamath Basin; limnological analysis of Upper Klamath lake data.
- Native American Rights Fund (NARF) – TMDL and Oregon SB1010 Non Point Pollution Research and Modeling in the Klamath Basin.
- US Bureau of Reclamation/JC Headwaters – Upper Klamath Lake Paleolimnological Study and Reservoir Water Quality Modeling Review.
- US Geological Survey Biological Resources Division – Fish Kill Water Quality Study on Upper Klamath Lake.
- The Nature Conservancy – Monitoring and Inventory at the Sycan Marsh Preserve – Klamath Basin.

OTHER COMMITTEE and PROJECT INVOLVEMENT

- Scientific Review Committee for State of Oregon DEQ TMDL on Upper Klamath Lake.
- Technical Advisory Committees for State of Oregon DEQ TMDL and Oregon Dept. of Ag. 1010 Non-point Agricultural Pollution Program
- Upper Klamath Lake fisheries, eutrophication, and watershed research.
- Technical Advisor for State of Oregon Health Division on toxic algal blooms in Oregon Lakes.
- Wood River Wetland and Channel Restoration Team.
- Williamson River and Wetland Restoration Technical Committee.
- Endangered Lost River and Shortnose Sucker Recovery Team.
- Colleague (peer) reviewer for U.S. Geological Survey Portland Water Resources Division technical reports.
- Klamath River Basin Fisheries Task Force Upper Basin Amendment Technical Team.

ACADEMIC ACTIVITIES

- Oregon State University Graduate Committee for M.S. Thesis: Nutrient export from irrigated cattle pasture in the Wood River Valley, Oregon.
- Lecturer in the Environmental Sciences Program at the Oregon Institute of Technology and Southern Oregon University.
- Humboldt State University graduate committee of Margaret Forbes, M.S. Thesis: Horizontal Zonation of periphyton in Hanks Marsh, Upper Klamath Lake, Oregon. , 1997.
- Lecturer for a graduate level course in Aquatic Ecology at the University of North Carolina, Chapel Hill.
- Organized and taught laboratory classes in biological and physical/chemical Limnology (aquatic ecology) the University of Idaho.
- Lecturer for a general biology laboratory classes at the University of North Carolina, Chapel Hill.
- Presented aquatic workshops for Dakubetede Environmental Education Program, Headwaters Environmental Center, Orion Society Forgotten Language Tour, and Oregon Trout's Salmon Watch Program.
- Affiliate Faculty Dakubetede Environmental Education Program/Antioch and Prescott Colleges.

PROFESSIONAL AFFILIATIONS

- American Society of Limnology and Oceanography.
- North American Lake Management Society.
- Oregon Lakes Association – Board of Directors 1998-2001
- American Fisheries Society.
- Pacific Fishery Biologists
- Ecological Society of America – Aquatic Ecology Section

AWARDS

- Awarded the U.S. Fish and Wildlife Service Distinguished Service Award from the Seattle National Fisheries Research Center in 1988.

- One of three lead biologists awarded the 1996 Conservation Achievement Award from the Western Division of the American Fisheries Society for research and recovery efforts on the endangered Lost River and shortnose suckers and their habitats.

POSITIONS PREVIOSLY HELD

AQUATIC ECOLOGIST Klamath Tribe Natural Resources, P.O. Box 436, Chiloquin, Oregon, 97624.
Responsible for coordinating and performing research on phytoplankton bloom dynamics and eutrophication trends in lakes and tributaries; including fisheries, watershed, wetland, and tributary linkages/ecology and restoration. Also responsible for wetland, water quality and endangered fish species management. Supervised 1-6 employees. February 1988 to November 1997. (Doctoral research was completed during this tenure).

FISHERY BIOLOGIST U.S. Fish and Wildlife Service, National Fishery Research Center, Seattle, WA 98115.
Performed and coordinated limnological and fisheries research for an inter-agency endangered fish recovery program on Upper Klamath Lake and its watershed. Responsible for monitoring development of massive algal blooms and associated limnological conditions as they relate to fish distribution and habitat. April 1987 to February 1988.

RESEARCH ASSOCIATE Department of Fish and Wildlife Resources, University of Idaho, Moscow, Idaho 83843.
Responsible for procurement of continued funding and research leader for ongoing studies on blue-green algal toxicity. Initiated funding, designed, and conducted research on the use of in situ substrate to study periphyton growth as an early indicator of increasing eutrophication rates in Lake Pend Oreille, Idaho. May 1986 to April 1987.

RESEARCH ASSISTANT Department of Fish and Wildlife Resources, University of Idaho, Moscow, Idaho 83843.
Designed and conducted research on blue-green algal toxicity in lakes of northern Idaho. Supervised five employees in limnology laboratory. Assisted in Payette Lake eutrophication-sewer study, Twin Lakes eutrophication study, and Bear Lake Marsh nutrient processing study. January 1984 to May 1986.

TEACHING ASSISTANT Department of Fish and Wildlife Resources, University of Idaho, Moscow, Idaho 83843.

Taught and organized laboratory classes in biological and physical-chemical limnology. January 1984 to December 1985.

JOURNAL ARTICLES

Kann, J. and E. B. Welch. Wind control on water quality in shallow, hypereutrophic Upper Klamath Lake, Oregon. 2005. Lake Reserv. Manage. 21(2):149-158

Eilers J. , J. Kann, J. Cornett, K. Moser, A. St. Amand. 2004. Paleolimnological evidence of change in a shallow, hypereutrophic lake: Upper Klamath Lake, Oregon. Hydrobiologia 520: 7-18.

Terwilliger, M.R., D.F. Markle , and J. Kann,. 2003. Associations between water quality an daily growth of juvenile shortnose and Lost River suckers in Upper Klamath Lake, Oregon. Trans. Am. Fish.Soc. 132:691-708

Kann, J., and V. H. Smith. 1999. Chlorophyll as a predictor of elevated pH in a hypereutrophic lake: estimating the probability of exceeding critical values for fish success using parametric and nonparametric models. Can. J. Fish Aquat. Sci 56: 2262-2270

Barbiero, R. P., and J. Kann. 1994. The importance of benthic recruitment to the population of Aphanizomenon flos-aquae and internal loading in a shallow lake. J. Plankton Res. 16(11): 1581-1588.

Kann, J. and C. M. Falter. 1989. Periphyton as indicators of enrichment in Lake Pend Oreille, Idaho. Lake Reserv. Manage. 5(2): 39-48.

Kann, J. and C. M. Falter. 1987. Development of toxic blue-green algal blooms in Black Lake, Kootenai County, Idaho. Lake Reserv. Manage. 3:99-108.

REPORTS

Kann, J., 2005. Review of Diamond Lake Toxic Algal Monitoring Program, 2001-2004. Summary report prepared for USFS Umpqua National Forest, 2900 NW Stewart Parkway, Roseburg, OR 97470.

Kann, J., 2005. Lake Selmac Toxic Algal Sampling. Summary report prepared for Josephine County Parks Department, 125 Ringuettte St., Grants Pass, Oregon, 97527.

Kann, J., C. Pryor, and G. Matthews. 2004. Water Quality Baseline Surveys In the Wood River Valley, Oregon. Vol. 5 In: Klamath Basin Rangeland Trust 2003 Pilot Project

Monitoring Report. Klamath Basin Rangeland Trust, P.O. Box 4310, Medford, Oregon 97501.

Kann, J., and G. Reedy. 2004. Fish and Habitat Surveys In the Wood River Valley, Oregon. Vol. 6 In: Klamath Basin Rangeland Trust 2003 Pilot Project Monitoring Report. Klamath Basin Rangeland Trust, P.O. Box 4310, Medford, Oregon 97501.

Kann, J., C. Pryor, and G. Matthews. 2003. Water Quality Monitoring In the Wood River Valley, Oregon. In: Klamath Basin Rangeland Trust 2002 Pilot Project Monitoring Report. Klamath Basin Rangeland Trust, P.O. Box 4310, Medford, Oregon 97501.

Kann, J., G. Reedy, and J. Kiernan. 2003. Biological Monitoring In the Wood River Valley, Oregon. In: Klamath Basin Rangeland Trust 2002 Pilot Project Monitoring Report. Klamath Basin Rangeland Trust, P.O. Box 4310, Medford, Oregon 97501.

Eilers J., K. Vaché and J. Kann. 2002. Tenmile Lake Nutrient Study: Phase II Report. Report Submitted to Tenmile Lakes Basin Partnership – Supported by Oregon Department of Environmental Quality and City of Lakeside, Oregon.

Eilers J. and J. Kann. 2002. Diamond lake Database and Toxic Bloom Analysis, 2001. Final Report Submitted to U.S Forest Service, Umpqua National Forest, Roseburg, OR.

Eilers J. , J. Kann, J. Cornett, K. Moser, A. St. Amand, C. Gubala. 2004. Recent Paleolimnology of Upper Klamath Lake, Oregon. Final Report Submitted to U.S. Bureau of Reclamation, Klamath Falls Project Office, Klamath Falls, OR, 97603 Conract 9-FG-20-17730.

Kann, J., D. Perkins, and G.G. Scoppettone. 2000. The role of poor water quality and fish kills in the decline of endangered Lost River and shortnose suckers in Upper Klamath Lake. U.S. Geological Survey, Biological Resources Division Final Report Submitted to U.S. Bureau of Reclamation, Klamath Falls Project Office, Klamath Falls, OR, 97603 -- Contract 4-AA-29-12160. (in revision: Environmental Biology of Fishes)

Kann, J. 1999. 1998 Monitoring Program for toxic Microcystis blooms in Tenmile Lakes, Oregon. Prepared for City of Lakeside, Lakeside, OR

Kann, J., and W. W. Walker. 1999. Nutrient and Hydrologic Loading to Upper Klamath Lake, Oregon, 1991-1998. Klamath Tribes Natural Resources Department-U.S. Bureau of reclamation Cooperative Studies. U.S. Bureau of Reclamation Klamath Falls Project Office, Klamath Falls, OR 97603. 106p.

Kann, J., and D. Gilroy. 1998. Ten Mile Lakes toxic Microcystis bloom, September-November 1997. Oregon Health Division Technical Report. Environmental Services and Consultation Center for Environment and Health Systems, OHD, 800 NE Oregon St., Ste. 608, Portland, OR 97232.

Kann, J. 1997. Ecology and water quality dynamics of a shallow hypereutrophic lake dominated by cyanobacteria (blue-green algae). Chapter 1: Chlorophyll as a predictor of elevated pH in a hypereutrophic lake: estimating the probability of exceeding critical values for fish success using parametric and nonparametric models. Chapter 2: Effects of nutrients, consumers, and physical factors on phytoplankton succession and dominance in a shallow hypereutrophic lake. Ph.D. Dissertation, University of North Carolina, Chapel Hill, 1997.

Kann, J. 1997. Effect of Lake Level Management on Water Quality and Native Fish Species in Upper Klamath Lake, Oregon. Draft Klamath Tribes Research Report. 19 pp.

Campbell, S. G., W. J. Ehinger, and J. Kann. 1993. Wood River Hydrology and Water Quality Study. In: C. Campbell (ed.). Environmental Research in the Klamath Basin, Oregon - 1992 Annual Report. Bureau of Reclamation Technical Report R-93-16. pp. 9-92.

Kann, J. 1993. Limnological Trends in Agency Lake, Oregon - 1992. In: C. Campbell (ed.). Environmental Research in the Klamath Basin, Oregon - 1992 Annual Report. Bureau of Reclamation Technical Report R-93-16. pp. 91-134.

Kann, J. 1993. Agency Lake Limnology, 1990-91. In: C. Campbell (ed.). Environmental Research in the Klamath Basin, Oregon - 1991 Annual Report. Bureau of Reclamation Technical Report R-93-13. pp. 103-110.

Coleman, M., J. Kann, and G. Scoppettone. 1988. Life History and Ecological Investigations of Catostomids from the Upper Klamath Basin Oregon. U.S. Fish and Wildlife Service Annual Report. National Fisheries Research Center, Seattle WA. 113pp.

Kann, J. and C. M. Falter. 1985. Blue-green algae toxicity in Black Lake, Kootenai County, Idaho. Idaho Water Resources Research Institute. Research Technical Completion Report G903-02. NTIS PB86 157385/AS.

PRESENTED PAPERS

Kann, J. 2004. Toxic algal blooms in Lake Selmac, Oregon. Oregon Lakes Association Annual Meeting, Bend, Oregon. September, 2004.

Kann, J. 2004. External loading and sources of phosphorus and nitrogen in Upper Klamath Lake. Upper Klamath Basin Science Workshop, Klamath Falls, Oregon. February 3-6, 2004.

Kann, J. 2004. Internal loading and sources of phosphorus and nitrogen in Upper Klamath Lake. Upper Klamath Basin Science Workshop, Klamath Falls, Oregon. February 3-6, 2004.

Kann, J. 2003. Toxic algal screening program for Tenmile Lakes, Oregon. Paper presented at 2003 Oregon Lakes Association Annual Meeting, October 10, 2003. Lakeside, Oregon. (Invited)

Eilers J. , K. Vache, J. Kann, J. Cornett, K. Moser, and A. St. Amand. 2003. Tenmile Lake Phase II Nutrient Study. Paper presented at 2003 Oregon Lakes Association Annual Meeting, October 10, 2003. Lakeside, Oregon.

Terwilliger, M. R., P. A. Murtaugh, J. Kann, and D. F. Markle. 2001. Modeling associations between water quality and daily growth of juvenile Lost River and shortnose suckers in Upper Klamath Lake, Oregon. Paper presented at 2003 Oregon American Fisheries Society Annual Meeting, Eugene, Oregon (Feb 26-28, 2003).

Kann, J. 2002. Updated AFS talk: The role of blue-green algal blooms, climate, and lake level in fish kill and water quality dynamics in Upper Klamath Lake. Paper presented at 2002 International Conference American Institute of Hydrology: Hydrologic Extremes: Challenges for Science and Management. October 13-17 2002. Portland, Oregon. (Invited)

Kann, J. 2002. The role of blue-green algal blooms, climate, and lake level in fish kill and water quality dynamics in Upper Klamath Lake. Paper presented at Oregon Chapter American Fisheries Society Meeting, Sun river, Oregon, February 27-March 1 2002. Bend, Oregon. (Invited)

Kann, J. and M. Jones. 2001. Toxic Anabaena bloom in Diamond Lake, 2001. Paper presented to the Oregon Lakes Association Annual Meeting, Portland Oregon. September 2001.

Terwilliger, M. R., P. A. Murtaugh, J. Kann, and D. F. Markle. 2001. Associations between water quality and daily growth of juvenile shortnose suckers (Chasmistes brevirostris) and Lost River suckers (Deltistes luxatus) in Upper Klamath Lake, Oregon. Paper presented at 2001 Joint Annual Meeting of ASIH and AES in State College, Pennsylvania (July 5-10, 2001).

Eilers J., J. Kann, J. Cornett, K. Moser, A. St. Amand, C. Gubala. 2001. Recent Paleolimnology of Upper Klamath Lake, Oregon. Paper presented at Klamath Basin Fish and Water Management Symposium, Arcata, CA, May 2001.

Eilers, J, J. Kann, and C. Gubala. 2000. Recent history of Upper Klamath Lake as viewed from the mud. Paper presented at Oregon Lakes Association Annual Meeting, Oregon Institute of Technology, Klamath Falls, OR October 6-7, 2000.

Kann, J. 2000. The role of blue-green algal dynamics, water quality, and mixing in recurrent fish kills in a shallow lake. Paper presented at WALPA 13th Annual Conference on Lakes, Reservoirs and Watersheds. SeaTac, WA. April 13-15, 2000. (update of below paper)

Kann, J. 1999. The role of wind-driven mixing in determining water quality dynamics in a shallow, hypereutrophic lake. Paper presented at North American Lake Management Society 19th International Symposium on Lake and Reservoir Management, Reno, NV. December, 2000.

Kann, J. 1999. Limnological trends associated with fish kills in Upper Klamath Lake, Oregon. The 3rd Klamath Basin Watershed Restoration and Research Conference. Oregon Institute of Technology, Klamath Falls, Oregon. March 9-11, 1999

Kann, J. 1998. Toxic Algae in Oregon Lakes: Tenmile Lakes Case Study. Oregon Lakes Association: Problems and Opportunities in Southern Oregon Lakes. Diamond Lake, Oregon. October 23-24, 1998

Perkins, D. L., J. Kann, and G. Scoppettone. 1998. The role of poor water quality and repeated fish kills in the decline of endangered Lost River and shortnose suckers in Upper Klamath Lake. Presented by J. Kann at Pacific Fishery Biologists 60th Meeting, Kelseyville, CA. October 15-17, 1998.

Kann, J. 1998. Invited Speaker for the Oregon State University Hydrology Seminar Series: Multi-Objective Water Resources Planning in Crisis- Case Study of the Klamath River Watershed. Corvallis, Oregon, April 29th, 1998

Kann, J. 1995. Effect of lake level management on water quality and native fish species in Upper Klamath Lake, Oregon. Paper presented at the First Klamath Basin Ecosystem Research and Restoration Coordination Meeting, Oregon Institute of Technology. May 15, 1995. An updated version was also presented at the 27th Annual Meeting of the Desert Fishes Council, Reno, Nevada, November 16-19, 1995.

Kann, J. 1995. Effect of lake level management and watershed dysfunction on water quality and native fishes in Upper Klamath Lake, Oregon. Paper presented at the American Institute of Hydrology Symposium: Stresses Placed on Water resources and Aquatic Biota by Managing Natural Resources. Ashland, Oregon October 16-17, 1995. (Invited)

Kann, J. 1994. Watershed dysfunction, lake ecology, and incorporation of non-fish aquatic constituents into watershed studies. Technical Workshop provided for the Watershed Management Council Fifth Biennial Conference: Watersheds >94 - Respect, Rethink, Restore. Ashland, Oregon. November 16-18, 1994. (Invited)

Kann, J. 1994. Phytoplankton/nutrient dynamics and internal loading in a shallow hypereutrophic lake dominated by the blue-green alga Aphanizomenon flos-aquae.

Paper presented at North American Lake Management Society 14th International Symposium on Lake and Reservoir Management, Orlando, FL. October 31-November 5, 1994.

Beaver, J, R., and J. Kann. 1994. Zooplankton dynamics relative to water quality in Upper Klamath Lake, Oregon (1987-1993). Poster presented at North American Lake Management Society 14th International Symposium on Lake and Reservoir Management, Orlando, FL. October 31-November 5, 1994.

Beaver, J, R., and J. Kann. 1994. Relationship between Daphnia and Aphanizomenon in Upper Klamath Lake, Oregon. Poster presented at American Society of Limnology and Oceanography 1994 Meeting, Miami, FL. June 12-16, 1994.

Kann, J. 1994. Watershed initiatives and sustainability in the Klamath Basin Ecosystem. Paper presented to The Presidents Council on Sustainable Development, Western Regional Team on Natural Resources Management and Protection. South Shore Lake Tahoe, NV. October 4-6, 1994. (Invited)

Kann, J. 1994. Watershed dysfunction, the ecology of Upper Klamath Lake, and downstream linkages. Paper presented to the Governors Watershed Enhancement Board: "Who Will Catch the Rain?" Conference. Ashland, OR. January 27-28, 1994. (Invited)

1993. Member of a scientific panel on blue-green algal ecology and management. North American Lake Management Society 13th International Symposium on Lake and Reservoir Management, Seattle WA. November 30-December 4, 1993. (Invited)

Kann, J. 1993. Water quality and habitat enhancement. Presented at Governors Watershed Enhancement Board Workshop: Watershed Improvement – Let's Get To It! Oregon Institute of Technology. June 16, 1993. (Invited)

Kann, J. 1992. The current condition of the Klamath watershed: what is the extent of the alteration of hydrology, habitat and fish and wildlife populations? What can be done to restore the river and its tributaries? Paper presented at the above Session at the Klamath Watershed Forum: A Conference on the Future of the Klamath River. Pacific Rivers Council. Oregon Institute of Technology. May 16, 1992. (Invited)

Kann, J. and V.H. Smith. 1991. Chlorophyll as a predictor of elevated pH in a hypereutrophic lake: estimating the probability of exceeding critical values for fish success. Paper presented at North American Lake Management Society 11th International Symposium on Lake and Reservoir Management, Denver, CO November 10-13, 1991.

Kann, J. 1989. Cultural eutrophication trends and effects on native fishes of Upper Klamath Lake, Oregon. Paper presented at Pacific Northwest Regional Workshop on Lake and Reservoir Management, September 15-16, 1989. Seattle, WA.

Kann, J. and C. M. Falter. 1989. Periphyton as indicators of enrichment in Lake Pend Oreille, Idaho. Paper presented at North American Lake Management Society 8th International Symposium on Lake and Reservoir Management, St Louis, MO. November 16-18, 1988.

Kann, J. 1988. Upper Klamath Lake, Oregon: hypereutrophy and endangered species. Paper presented at North American Lake Management Society 8th International Symposium on Lake and Reservoir Management, St Louis, MO. November 16-18, 1988.

Kann, J. and C. M. Falter. 1986. Controlling factors of a toxic blue-green algae bloom in Black Lake, northern Idaho. Paper presented at the Idaho American Fisheries Society Annual Chapter Meeting, Boise, Idaho. March 1986.

PROFESSIONAL COURSES

- Introduction to Geographic Information Systems for Water Resources Applications. American Water Resources Association, Reno, NV. November, 1992
- Mathematical Modeling of Lakes and Reservoirs. Duke University short course, November 7-11, 1988.
- Physical Habitat Simulation Modeling - IFG 310. USFWS Instream Flow Group, Ft. Collins, CO. November 1989.
- Field Techniques for Stream Habitat Analysis - IFG 205. USFWS Instream Flow Group, Ft. Collins, CO. August, 1988.
- Designing and Conducting Studies Using Instream Flow Incremental Methodology - IFG 200. USFWS Instream Flow Group, Ft. Collins, CO. March 1988.

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Re: OPUC UM 1209

CERTIFICATE OF SERVICE

I, Barbara Lee Norman certify that on November 21, 2005, I electronically served a copy of the **Karuk Tribe's Testimony** on all parties listed below. The Original Motion along with 5 copies was mailed to the Oregon PUC on October 22, 2005.

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The Effects of Altered Diet on the Health of the Karuk People

Kari Marie Norgaard, Ph.D.

November 2005

The Effects of Altered Diet on the Health of the Karuk People

Executive Summary

The Karuk people are intimately dependent upon salmon both physically and culturally. Salmon has been both the primary food and the basis of the prosperous subsistence economy of the Karuk people since time immemorial. The elimination of traditional foods including multiple runs of salmon, Pacific Lamprey, Sturgeon and other aquatic species has had extreme adverse health, social, economic, and spiritual effects on Karuk people. With the loss of the most important food source, Spring Chinook salmon in the 1970s, the Karuk people hold the dubious honor of experiencing one of the most recent and dramatic diet shifts of any Native tribe in the United States.

This report details the health effects of the loss of traditional foods on the Karuk Tribe. Physical health is linked to food quantity and quality, culture, economic conditions and mental health. In addition to data on disease rates, this report addresses the broader social, economic and cultural impacts of the loss of traditional food on Karuk tribal health. Particular attention is paid to salmonid species because of their central importance as food, their remarkably recent and dramatic decline, and the link made by fisheries scientists between salmonid species decline and the presence of the Klamath River dams currently up for re-licensing under FERC.

This report expands the documentation and analysis of the Preliminary Report released in 2004. Data on health and economic status of the Karuk Tribe have been updated, and in some cases new disease frequencies are reported to replace earlier calculations. The methodology of this study builds on the preliminary report in three important ways: it contains additional analysis of health records, reports data from the Karuk Health and Fish Consumption Survey (a 61 question survey with a response rate of 34%) and 18 additional in depth interviews. The Karuk Health and Fish Consumption Survey allowed for the collection of quantitative data regarding economic patterns, health conditions and fish consumption that has been long absent in the broader discussion of tribal impacts of declining riverine health. Mental health impacts of the loss of culture and food supply are also expanded. Finally, this report contains analysis of the health care costs stemming from the altered diet of the Karuk Tribe.

The loss of traditional food sources is now recognized as being directly responsible for a host of diet related illnesses among Native Americans including diabetes, obesity, heart disease,

tuberculosis, hypertension, kidney troubles and strokes. Around the world when Native people move to a "Western" diet rates of these diseases skyrocket. The estimated diabetes rate for the Karuk Tribe is 21%, nearly four times the U.S. average. The estimated rate of heart disease for the Karuk Tribe is 39.6%, three times the U.S. average. Despite their epidemic levels, diabetes has recently appeared in the Karuk population. Most families report the first appearance of diabetes in the 1970s. Data from the 2005 Karuk Health and Fish Consumption Survey show that the loss of the most important food source, the Spring Chinook Salmon run, is directly linked to the appearance of epidemic rates of diabetes in Karuk families.

Identified health consequences of altered diet for the Karuk people include high rates of Type II diabetes, heart disease and hypertension. These health consequences stem from changes in the specific nutrient content of traditional foods such as salmon and acorns, as well as decrease in the physical benefits of exercise associated with their gathering. Mental, emotional, cultural and spiritual health benefits of eating and harvesting traditional Karuk foods exist as well.

Genocide and forced assimilation over the past century have led to a loss of traditional knowledge of relationships with the land (including preparation and acquisition of traditional foods) and a change in the tastes and desires of people. Yet despite these dramatic earlier events, the testimony of elders about foods they ate until recently indicate that considerable changes have also occurred within the last generation. These most recent changes are largely due to denied access to traditional foods. There are at least 25 species of plants, animals and fungi that form part of the traditional Karuk diet to which Karuk people are currently denied or have only limited access. Furthermore, the foods that were most central in the Karuk diet, providing the bulk of energy and protein: salmon and tan oak acorns are amongst the missing elements. The result is that Karuk people are currently denied access to foods that represented upwards of 50% of their traditional diet. Traditional fish consumption is estimated at 450 pounds per person per year (Hewes, 1973). In contrast, the present day Karuk people consume less than 5 pounds of salmon per person per year. Now so few fish exist that even ceremonial salmon consumption is limited.

Lack of traditional food impacts the Karuk Tribe not only due to decreased nutritional content of specific foods, but results in an overall absence of food, leaving Karuk people with basic issues of food security. The destruction of the Klamath river fishery has led to both poverty and hunger. Prior to contact with Europeans and the destruction of the fisheries, the Karuk, Hupa and Yurok tribes were the wealthiest people in what is now known as California. Today they are amongst the poorest. This dramatic reversal is directly linked to the destruction of the fisheries resource base.

The devastation of the resource base, especially the fisheries, is also directly linked to the disproportionate unemployment and low socio-economic status of Karuk people today. Before the impacts of dams, mining and over fishing the Karuk people subsisted off salmon year round for tens of thousands of years. Now poverty and hunger rates for the Karuk Tribe are amongst the highest in the State and Nation. The poverty rate of the Karuk Tribe is between 80 and 85%. The poverty rate is even higher for tribal members living in Siskiyou County.

Diet change also leads to a loss of culture and identity. The present ongoing destruction of the resource base leads to further cultural disruption for Karuk people today. Just as ceremonies surrounding fish and the more everyday activities of fishing, eeling and gathering mushrooms and huckleberries create and maintain community ties and provide identity, so too does their absence and decline lead to further cultural disruption. The present decreasing access to traditional foods must therefore be understood in the broader context of cultural genocide. Access to traditional food sources of salmon are also a basic human right. Access to salmon is also a matter of religious freedom. Numerous international treaties recognizes the right to food security and food sovereignty

The fact that Karuk tribal members are denied access to the healthy foods that supported them since time immemorial also costs society. When an entire Tribe faces epidemic rates of expensive conditions such as diabetes, sizable state, county and tribal medical resources will be used to address this problem. Recent research by the American Diabetes Association reveals that diabetes patients have an average annual per capita cost of health care at $13,243 per person per year in the United States. Given the 148 diabetic Tribal Members within the ancestral territory in 2004, the annual cost for Karuk Tribal members is estimated over 1.9 million dollars. However these increased medical care costs, paid by society as a whole, are not reflected in PacifiCorp's dam operation expenditures, nor are they withdrawn from the profits PacifiCorps receives from the production of electricity in a manner which damages the health of the Klamath riverine system. Instead the higher health care costs of increased diabetes in the Karuk population are bourne by society as a whole. PacifiCorps does not reimburse the Karuk Tribe, nor Siskiyou nor Humboldt Counties for the increased cost of health care that comes from the destruction of an abundant source of healthy food in the Klamath river. Any cost-benefit analysis of the dams should include the 1.9 million annually to provide medical services for the artificially high incidence of diabetes in the Karuk Tribe.

Key Findings

General Overview

- **The diet of the Karuk people has shifted dramatically since European contact due to denied access to traditional foods. The dramatic decline in eel and salmon populations that once supplied over half the Karuk diet has occurred within the lifetime of most adults alive today.**

- **The loss of the most important food source, the Spring Chinook Salmon run, is directly linked to the appearance of epidemic rates of diabetes in Karuk families.**

- **The American Diabetes Association has recently calculated the annual cost of diabetes in the U.S. at $13,243 per person (ADA, 2003). Given this figure the annual direct cost of providing health care for the artificially high rate of diabetes for Karuk Tribal members is 1.9 million dollars.** Per person indirect costs of diabetes in the form of lost workdays, permeant disability and premature death amount to an **additional $5,729 per person per year.**

- **Total direct and indirect costs** of diabetes for Karuk Tribal Members and descendants within the ancestral territory are **$2.75 million annually. Any cost-benefit analysis of the dams on the Klamath River should include the 2.75 million annually in direct and indirect costs for the artificially high incidence of diabetes in the Karuk Tribe.**

- **The elimination of traditional foods including multiple runs of salmon, Pacific Lamprey, Sturgeon and other aquatic species has had extreme adverse health, social, economic, and spiritual effects on Karuk people.**

- **Prior to contact with Europeans and destruction of the fisheries the Karuk people were amongst the wealthiest in California. Today they are amongst the poorest: poverty and hunger rates are amongst the highest in the State and Nation. Median income for Karuk families is $13,000 and 88.4-91.9% of tribal members in Siskiyou County live below the poverty line. This dramatic reversal is directly linked to the destruction of the fisheries resource base.**

- **Environmental Justice laws require that federal agencies identify and address adverse affects to human health or the environment of their actions on minorities and low-income populations.**

- **Historic fish consumption for the Karuk Tribe is estimated at 450 pounds of salmon per person per year or 1.2 pounds per day. Estimates for 2004 are less than 5 pounds of salmon per person per year.**

Health Effects of Denied Access to Traditional Foods

- **Traditional diet, especially salmon, is an important factor in both the prevention and treatment of diabetes. Traditional foods are higher in protein, iron, zinc, Omega 3 fatty acids and other minerals and lower in saturated fats and sugar.**

- **The estimated diabetes rate for the Karuk Tribe is 21%, nearly four times the U.S. average.**

- **The estimated rate of heart disease for the Karuk Tribe is 39.6%, three times the U.S. average.**

- **Diabetes is associated with severe and costly complications such as blindness, kidney failure, lower-extremity amputations and cardiovascular disease, disability, decreased quality of life and premature death that continue to affect American Indians disproportionately.**

- **The United Nations recognizes the right to food security and food sovereignty. Access to traditional food sources of salmon are a basic human right.**

- **Cultural benefits of the use of traditional food include beliefs about food healthfulness and spiritual provisioning, economic benefits, and place in the social fabric of community life.**

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CHAPTER ONE

THE SIGNIFICANCE OF TRADITIONAL FOODS

- There is overwhelming evidence that the elimination of traditional foods has had **adverse health, social, economic, and spiritual effects** on Native American people.
- The diet of the Karuk people has shifted dramatically since European contact under forces of assimilation and **in the past generation due to denied access to traditional foods.**
- With the loss of the most important food source, Spring Chinook salmon in the 1970s, the Karuk people hold the dubious distinction of experiencing **one of the most recent and dramatic diet shifts of any Native tribe in the United States**.
- The loss of the most important food source, the Spring Chinook salmon run, is directly linked to the appearance of epidemic rates of diabetes in Karuk families.
- A high percentage of Karuk people continue to fish and hunt traditional foods, however over 80% report that they are unable to harvest enough to meet their family needs.
- Despite their epidemic levels, diabetes has recently appeared in the Karuk population. Most families report the first appearance of diabetes in the 1970s.
- Traditional foods, especially salmon, are **higher in protein, iron, zinc, omega-3 fatty acids and other minerals and lower in saturated fats and sugar.**
- Environmental Justice laws **require** that federal agencies **identify and address adverse affects to human health or the environment of their actions on minorities and low-income populations**.

Since time immemorial Karuk people have relied directly on the land and rivers for food. Salmon, eel, sturgeon, steelhead trout, acorns, wild plants, nuts, seeds and game were plentiful and healthy sources of food for generations. Today the Karuk people are denied access to a significant percentage of their traditional foods. When obtainable, these former staples of their highly nutritious diet are available in quantities insufficient to even approach being primary food sources. Often the quality is compromised as well. Most glaring is the loss of several entire runs of salmon and the considerable decrease in all salmonid populations. The dramatic decline in eel and salmonid populations that once

supplied over half the Karuk diet has occurred within the lifetime of most adults alive today. With the loss of the most important food source, Spring Chinook salmon in the 1970s, the Karuk people hold the dubious honor of experiencing one of the most recent and dramatic diet shifts of any Native tribe in the United States.

The concept of "traditional food system" refers to the local foods available to an indigenous culture and the accepted patterns of use within that culture. The concept thus incorporates the socio-cultural values given to these foods and the way each food is acquired, processed and distributed according to age and gender. The concept extends as well to the chemical composition of the foods and to the nutrition and health consequences of all of these factors (Kuhnlein and Chan 2000, 596). The central thesis of this report is that Karuk people face significant and costly health consequences as a result of denied access to many of their traditional foods. Not only does a traditional diet prevent the onset of conditions such as obesity, diabetes, heart disease, kidney trouble and hypertension, a traditional diet of salmon and other foods is one of the best treatments for such conditions.

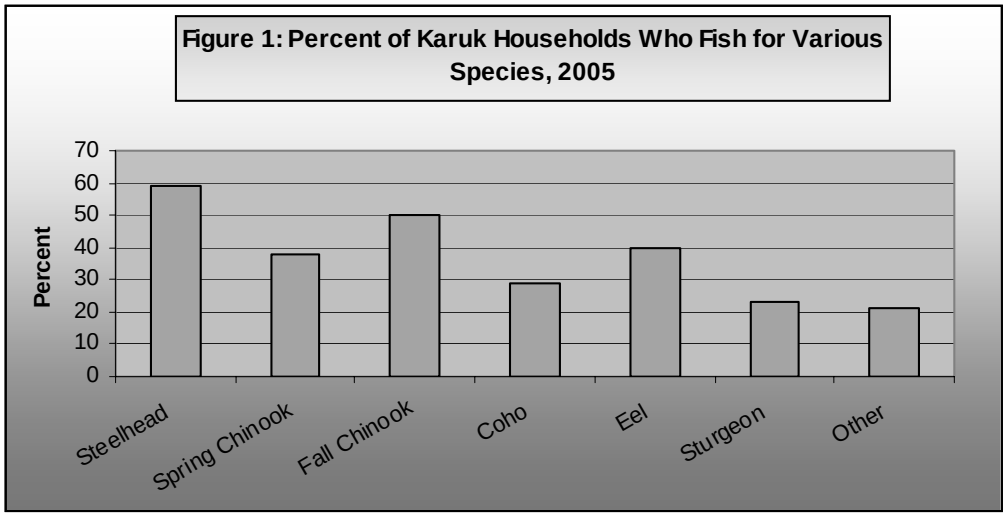
This study will provide an overall description of the present health and economic situation of the Karuk Tribe, describe dietary changes from traditional to present day, review causes of the altered diet and document some of the many significant health benefits of the traditional Karuk diet. The information presented in this report is complied from four main sources: archival material, in-depth interviews with Karuk tribal members, Karuk medical records and the 2005 Karuk Health and Fish Consumption Survey. The 2005 Karuk Health and Fish Consumption Survey was distributed to adult tribal members within the ancestral territory in the Spring of 2005. The survey had a response rate of forty percent, a total of 90 individuals. The use of multiple methods allows for triangulation between these different sources. Additional medical data has been obtained from relevant federal, state and county records. For a complete description of methods and data sources see Appendix A.

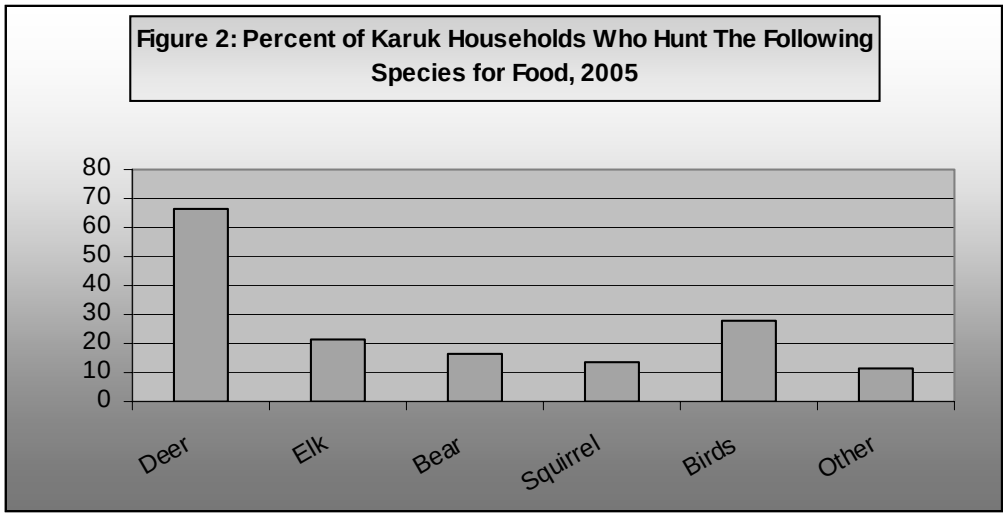
Karuk traditional foods, especially salmon, are higher in protein, iron, omega-3 fatty acids, zinc and other minerals and lower in saturated fats than the market foods that make up their present diet. Nutritional data show that these foods produce stronger hearts, blood and muscle tissue (Jackson 2005). Omega-3 fatty acids have been linked with a number of significant health benefits including reduced risk of heart attacks, strokes, Alzheimer and improved mental health and improved brain development in infants. Appendix B contains a table of traditional foods in the Karuk diet.

The often strenuous tasks of acquiring traditional food provided exercise that kept people in good physical condition. Because hunting, gathering, fishing, storing and preparing food was an

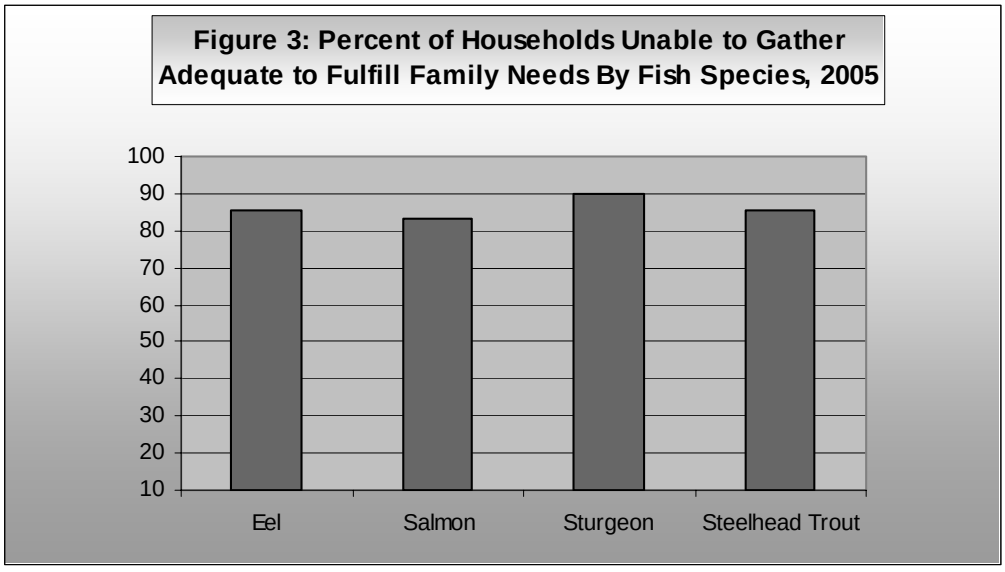
integral part of daily life and seasonal celebration, traditional food held great cultural, religious and social meaning for the Karuk people. These activities served as an important social "glue" by bringing people together to work, socialize and pass down values and information from one generation to the next. Food is central to some of the most serious social obligations for Karuk people – hospitality and caring for elders. Overall, the benefits of traditional foods include better nutrient density, the availability of key essential nutrients, physical activity during harvesting, lower food costs, the prevention of chronic disease by consumption of more nutritious food, and "multiple socio-cultural values and traditions that contribute to mental health and cultural morale" (Kuhnlein and Chan 2000, 615; Cantrell 2001).

While the Karuk made use of many traditional foods, the centrality of salmon as a critical food source is reflected in ancient ceremonies and practices, and in their ongoing attempts to rely on salmon to this day. Salmon is estimated to have made up close to 50% of the energy and total protein in the pre-contact diet of the Karuk (Hewes 1973). Deer and tan oak acorns were also of primary importance. Davis and Hendryx describe manzanita berries as the most important plant food source after acorns (1991). Despite the reduced availability of salmon and other fish, a high percentage of Karuk families report that someone in their household still fishes or hunts for food, as indicated in Figures 1 and 2 (data are from the 2005 Karuk Health and Fish Consumption Survey).





While earlier generations ate from the land, limited access to traditional food forces the present Karuk population to buy most of their food in stores and/or rely on government commodities. These changes represent a major dietary shift. Whereas earlier generations are estimated to have eaten over a pound of salmon per person per day (Hewes 1973), the current Karuk population consumed on average less than five pounds per person per year in 2003 and less than one-half pound per person in 2004. Even the availability of salmon for ceremonial purposes is severely limited (Ron Reed, personal communication). As illustrated in Figure 3, over eighty percent of households surveyed indicated that they were unable to gather adequate amounts of eel, salmon or sturgeon to fulfill their family needs.



The current scarcity of salmon is in contrast to its relative abundance in the recent past. Even Tribal members in their early 30's recount significant changes in the number of fish in their diet since childhood:

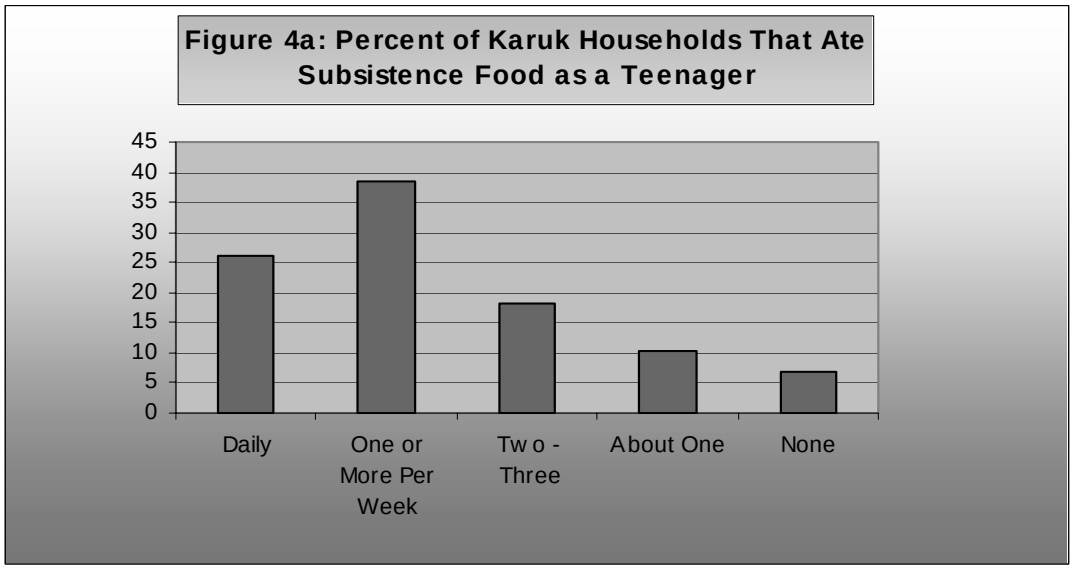
> "As I child I ate salmon three times a day."
>
> Bill Tripp, Traditional Karuk Fisherman, Age 31

> Dad worked in the summer and had good money, but during the winter, we didn't have a lot. We used freezers. We'd live on the salmon. Everyday we would have some kind of food cooked with the salmon. It was salmon patties, fried salmon, baked salmon, salmon cooked on the stick. It was either that or it was deer meat. So it was whatever was in the freezer that's what we got to eat. I noticed, as I got older, it was less and less. It's really hard now for me. Man, I remember being so tired of salmon patties. Now I just wish I had some. We ate it so often. My kids don't even know what it is. When we get it, we either cook it on a stick on a fire. It's like such a special thing that when we get it, that's what we do. I don't even bake it that often. It's either fried or on a stick. I barely have enough left over to make a salmon patty. My oldest kid is 9 and he hasn't even had any.
>
> Carrie Davis, Karuk Tribal Member, (in her early 30s)

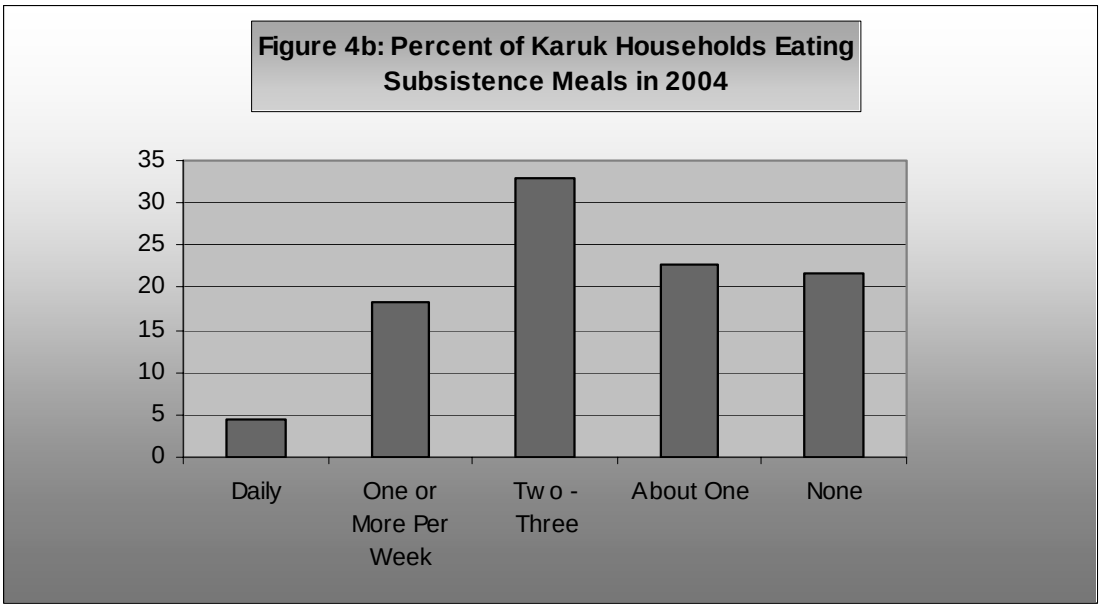
The Karuk Health and Fish Consumption Survey contained questions about the number of meals people ate that contained traditional foods now and in the past. Tribal members reported a drastic change in their lifetime in the number of their meals that contain traditional foods. As Blanche Moore explains:

> Well, sometimes we even had it for breakfast. But we had it at least twice a day. There was plenty of salmon. And I can remember cleaning so many salmon, me and my sisters. I don't think that I could do that now. I never learned to cut it up til I got older. But gosh, I can remember cleaning so many salmon. It'd just be tons of it. And I haven't seen it like that for quite a few years. There's a really big difference here.
>
> Blanche Moore, Karuk Tribal Member

As shown in Figure 4a, nearly 40 percent of respondents report eating meals with traditional foods once a week or more as a teenager, and another 25 percent once a day or more. Only about 7 percent indicated that they never ate traditional foods.



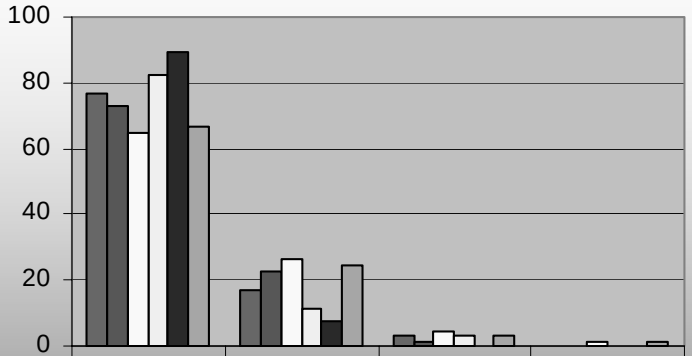
In contrast, as indicated in Figure 4b, less than 5 percent reported eating traditional foods on a daily basis in 2004, and only 17 percent once a week or more. The number who report never eating traditional foods rose to 22 percent. If we combine answers from the two most frequent categories of food consumption ("once a day or more," "two to three times per week") and compare between Figure 4a and 4b we see that the percentage of adult tribal members eating traditional foods once a week or more as a child to 2004 has dropped from 65 percent when they were teenagers to less than



25 percent in 2004. Note that because respondents are of different ages they were teenagers in different decades. Age breakdown of the data would presumably produce even more extreme shifts in diet for elders.

Despite the fact that up to 50% of tribal members report that they fish for Fall Chinook, 40% fish for Eel and Spring Chinook and over 20% for Coho and Sturgeon, as reported in Figure 5 below, most of those fishing in each household are not actually catching very many fish.

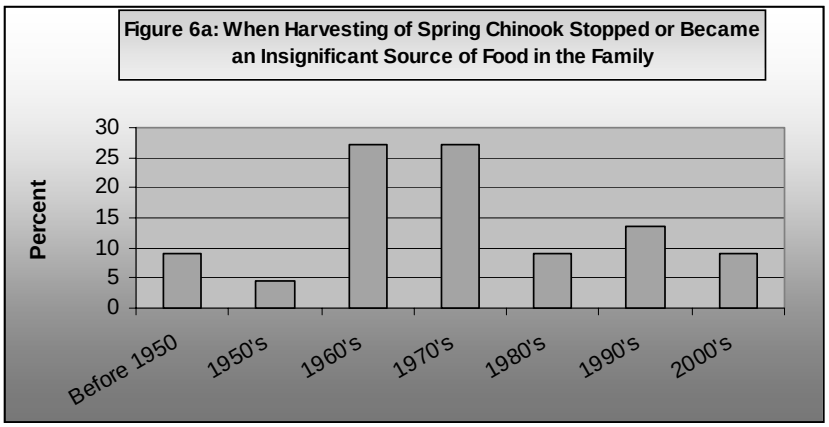
Figure 5: Amount of Fish Harvested By Household, 2004-2005 Season

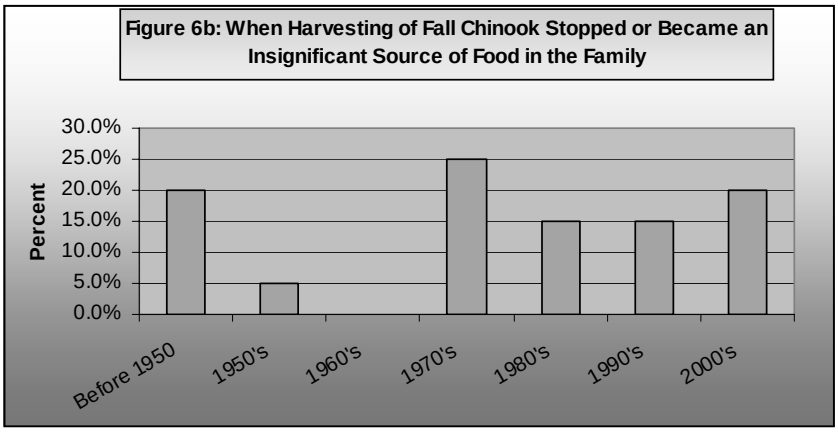


	None	10 or less	11 to 50	51 to 100
Eels	76.9	16.9	3.1	
Spring Chinook	72.7	22.7	1.5	
Fall Chinook	64.7	26.5	4.4	1.5
Coho	82.5	11.1	3.2	
Sturgeon	89.2	7.7	0.0%	
Steelhead	66.7	24.6	2.9	1.4

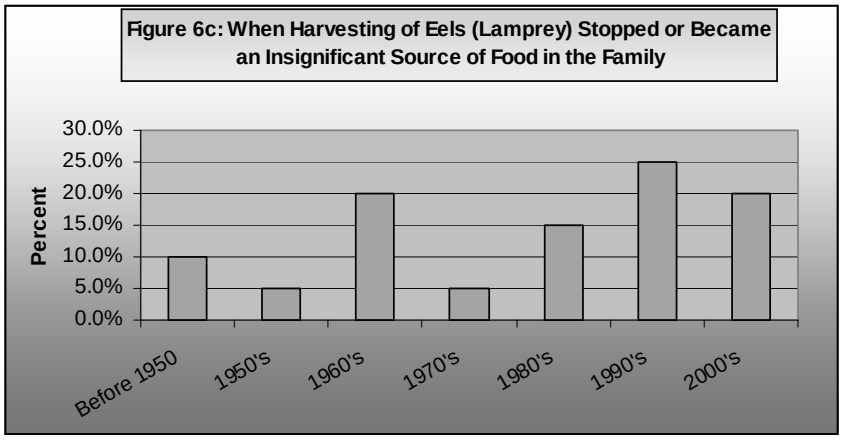
In the 2004 - 2005 season fishing for eels (Pacific Lamprey and other Lamprey species), Spring and Fall Chinook Salmon, Coho and Sturgeon all reached record lows. As indicated in Figure 5, most households that caught salmon, steelhead, eels, and sturegon report catching ten or fewer, and no households report catching more than 50 eels, Fall or Spring Chinook Salmon. Furthermore, forty percent of tribal members report that there are species of fish that their family gathered which they no longer harvest. As indicated in Figures 6a, b and c, for most of these species the decline is quite recent. Over half of respondents report that Spring Chinook became an insignificant source of food

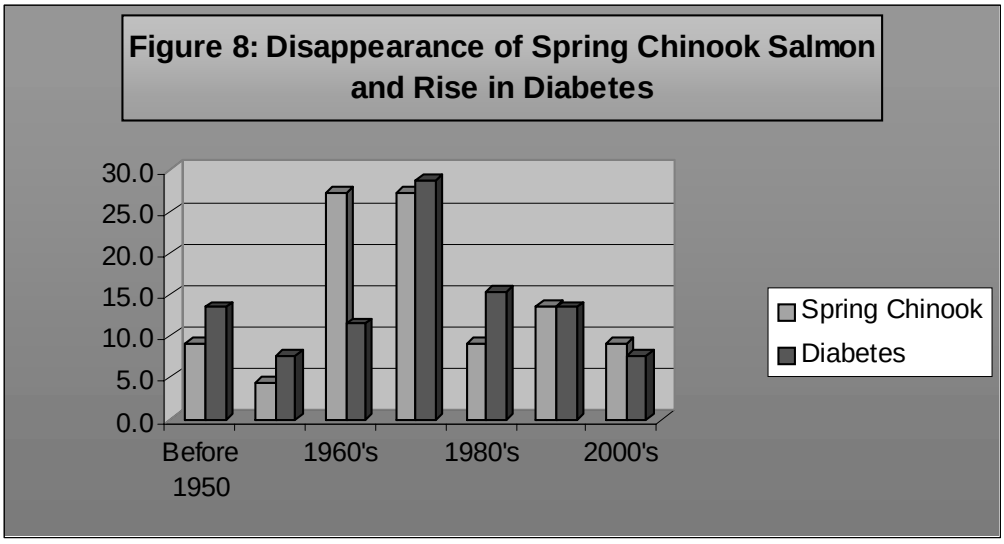
during the 1960s and 1970s, within a decade of the completion of Iron Gate dam, although some families continued to gather significant food into the 1980s and 90s.

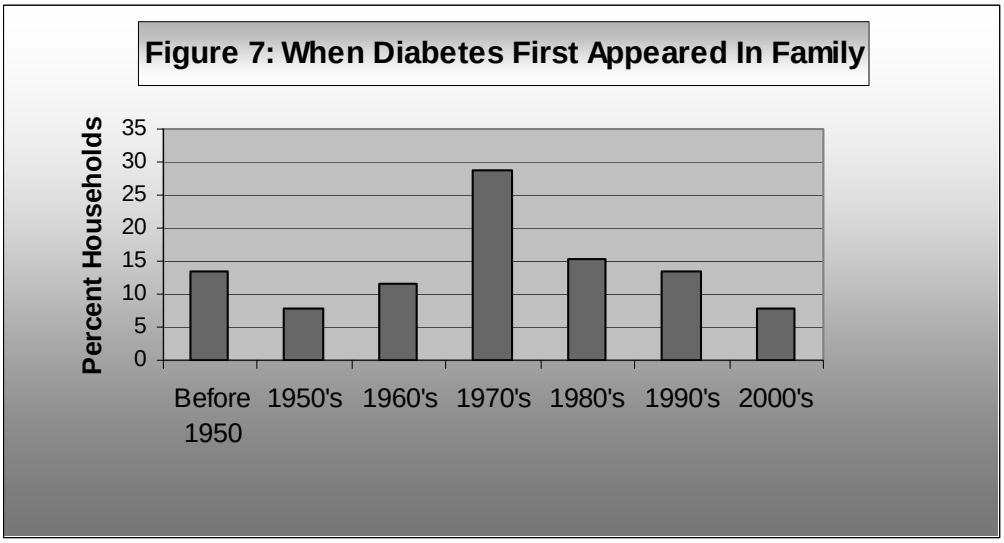




The loss of traditional food sources is now recognized as being directly responsible for a host of diet-related illnesses among Native Americans including diabetes, obesity, heart disease, tuberculosis, hypertension, kidney troubles and strokes (Joe and Young 1993). Indeed, diabetes is one of the most significant health problems facing Native peoples today (Olson, 2001). It is described as a new disease among this population and is the consequence of drastic lifestyle and cultural changes that have occurred since World War II (Joe and Young 1993). Indeed, diabetes has been described as the smallpox of the 21st century. The rate of diabetes in the Karuk Tribe is now estimated to be almost four times the U.S. national average. Despite their epidemic levels, diabetes has recently appeared in the Karuk population. Self report data from the Health and Fish Consumption Survey indicate that diabetes first appeared in most families (over 60%) since the 1970s, see Figure 7 below.







As illustrated in Figure 8 below, the first appearance of diabetes in families is directly linked to the loss of Spring Chinook salmon as a significant food source. Note that diabetes begins to appear in about 30% of Karuk families roughly ten years following the loss of Spring Chinook salmon as a significant food source. The fact that diabetes first appeared in Karuk families at the same time that Spring Chinook salmon became an insignificant food source in the diet can not be ignored. The relationship between the self-reported emergence of diabetes in the Karuk tribe and the decline in Spring Chinook availability is examined in more detail in Chapter 2.

Numerous studies outline how Type II diabetes is becoming a major problem for societies and cultures in which health status is influenced or generally shaped by external socio-cultural, political and economic forces – a description that fits the Karuk people all too well given the fact that the dams on the Klamath river are owned by an international company and managed by federal agencies. Accordingly, Type II diabetes has been described as a disease of "modernization" and "civilization" (Joe and Young 1993, 7). Not only do native people have some of the highest rates of Type II diabetes in the world, they are also more likely to suffer the serious complications associated with the disease, such as heart disease, kidney failure, blindness and limb amputations. The rate of heart disease in the Karuk Tribe is estimated to be three times the U.S. average. Heart disease is a leading cause of death for members of the Karuk Tribe and Native Americans generally. While rates of heart disease are decreasing in the general U.S. population, they are on the rise for Native Americans. Rates of strokes are also higher for Indian people. Other associated conditions such as obesity result from decreased nutrition. Obesity is an issue not only of altered diet, but of a sedentary lifestyle far removed from traditional food gathering practices. Nationally high rates of infant mortality for Native peoples are also linked to nutritional deficits. Nutritional data indicate that women with diets containing adequate protein experience fewer spontaneous abortions, premature births and healthier infants. Indian Health Services reports that the infant mortality rate for Native Americans is 21 times the national average (CRIHB 2004). Finally, as a result of the high prevalence of these diseases, Native people in the U.S. have an average life expectancy that is six years lower than the general population and the lowest median age in the United States (ibid). Given the dramatic change in diet

and the high incidence of diabetes and heart conditions in the Karuk Tribe, high incidence of the conditions mentioned above are suspected within the Karuk Tribe as well.

Salmon was a critical food and the basis of a prosperous traditional economy for the Karuk people. Therefore it should come as no surprise that the destruction of the fishery has resulted in both poverty and hunger. For Karuk people food security has been an ongoing problem since European contact. The Karuk, Hupa and Yurok were, until relatively recently, the wealthiest people in what is now known as California (McEvoy 1986). The basis of this non-monetary wealth was the abundance of natural resources, most prominently salmon (ibid). Indeed since the destruction of their resource base the Karuk people have now become some of the poorest in California (U.S. Census Bureau 2000, KTOC 2004). With the destruction of the once abundant salmon population it is no longer possible for people to subsist on these foods. Ron Reed, traditional fisherman and cultural biologist for the Karuk Tribe notes the impossibility of feeding the current tribal population from the one remaining fishing site at Ishi Pishi falls: "We had over 100 villages up and down the Klamath River, with fishing sites associated with each village. Now we are trying to feed our people off one fishery. It's not possible." Other important food sources, including deer, tan oak acorns, manzanita berries and mushrooms, are currently in limited supply due to lack of burning and other factors such as resource competition with non-Indian groups. In the absence of salmon and other foods from the land, people must purchase foods in grocery stores. Today's conditions of poverty mean that covering basic needs is a real issue for many community members. Rates of hunger and food insecurity in the region are extremely high.

Communities are defined as food secure when all members have access to nutritionally good, safe and culturally acceptable food through local non-emergency sources at all times. Recent U.S. Department of Agriculture studies show that while roughly 90% of the US population is food secure, only 78% of Native Americans in the United States are food secure (U.S. Department of Agriculture, 1999). Self report data from the Karuk Health and Fish Consumption Survey indicate that 20% of Karuk people consume commodity foods and another 18 percent of those responding indicated that they would like to receive food assistance but do not qualify. Difficulty in meeting basic needs results in overwhelming physical and psychological stress.

The evolution of health and disease among Native Americans have been termed an "unnatural history" (Campbell 1989). For this reason, present day Karuk health and diet must be examined and understood in its historical and political context, beyond the mere cataloging of isolated, individual determinants and outcomes. It is for this reason that diabetes researcher Kue

Young writes that "resolution of the major health problems of Native Americans requires redressing the underlying social, cultural and political causes of those problems" (1997, 164).

For Indian people in the United States generally there have been rapid changes in diet and lifestyle over the past centuries (Jackson 1993). For Karuk people these changes occurred even faster – in most families significant changes in diet have occurred in two generations or less. Rugged terrain and remote location meant that it was not until the European discovery of gold in the mid-1800's that major social disruption occurred for Karuk people (Bell 1991, Norton 1979). This invasion was followed by damage to the fishery due to commercial over-fishing and other causes (McEvoy 1986). Rapid changes in diet accompanied these social and ecological disruptions, as will be described in Chapter Two.

The present situation in which Karuk people face serious health problems resulting from denied access to their traditional food fits within the framework of what is known as "environmental justice." For the past several decades it has been recognized that poor people and people of color are most likely to pay the price of various forms of environmental degradation (Bullard 1993). For some this has meant exposure to environmental hazards such as mercury contamination, herbicide exposure or air pollution. For others the frame of environmental justice has referred to the denied access to traditional resources or unequal access to decision-making regarding the use of local resources. Both definitions apply to the present situation in which the Karuk people face alarmingly high rates of diseases as a consequence of the loss of their traditional foods and continue to be disenfranchised through government processes that fail to acknowledge their fishing rights and rights to religious freedom.

Currently environmental justice laws require that federal agencies identify and address the effects of their decisions on minorities and low-income population, including adverse impacts on human health and the local environment, and the equitable distribution of benefits and risks. (Executive Order 12898). Furthermore, California State law SB115 requires the state to conduct programs and policies that substantially affect human health or the environment in a manner that ensures the fair treatment of people of all races, cultures and income levels. SB 115 also requires the state to identify and consider differential patterns of consumption of natural resources among people of different socio-economic classifications. And the State of California also has trust obligations to ensure that its Sovereign resources are available for trust protected uses. Fishing has always been such a use.

CHAPTER TWO

DENIED ACCESS TO TRADITIONAL FOODS

"Eels, they're disappearing too. There was a time when I was a teenager when I would go down there and get 150 of them, smoke em up and have some for the year. But this year I probably got, maybe 50 or 60 of them all year. When you're getting only 2 and 3 at a time you can't put em up cause you just eat them, right there on the spot. Its nice to be able to have that, save it for the winter when you need that really good food."

Bill Tripp, Traditional Karuk Fisherman

"Last year we caught an all-time low, less than a hundred fish at Ishi Pishi Falls with extended effort, meaning that we was down there fishing hard and we had a lot of people fishing hard down there, and that's not all right. What about the lamprey? What about the sturgeon? What about the spring salmon? What about the fall run? We're talking about a total collapse in our fishery."

Ron Reed, Traditional Karuk Fisherman

- Historic fish consumption for the Karuk Tribe is estimated at **450 pounds of salmon per person per year or 1.2 pounds per day.**
- Fish consumption for the Tribe in 2003 was estimated at less than 5 pounds per person per year, **a 90 fold decrease.**
- **In 2004 fish consumption dropped again to one half pound per person per year.**
- There are at least 25 traditional foods to which Karuk people currently have denied or limited access. **These foods represent upwards of 50% of the traditional Karuk diet.**
- A significant percentage of tribal members rely on commodity foods in lieu of salmon and other traditional foods. These foods are of much lower nutritional value.
- **Denied access to traditional foods** is a primary reason for the altered Karuk diet today.

The Altered Karuk Diet of Today

Karuk people face one of the most significant and recent diet shifts of any Native Tribe in the United States. There are at least 25 species of plants, animals and fungi that form part of the traditional Karuk diet to which Karuk people are currently denied or have only limited access. And the foods that were critical in the Karuk diet because they provided the bulk of energy and protein – salmon and tan oak acorns -- are amongst the least available. The result is that Karuk people are currently denied access to foods that represented upwards of 50% of their traditional diet. Whereas historic

fish consumption for the Karuk Tribe is estimated at 450 pounds per person per year, fish consumption for the Tribe based on the tribal fish catch in 2004 is estimated at less than one half pound per person per year. Populations of salmon, steelhead, and green and white sturgeon runs have declined dramatically during the last century (McEvoy 1986). In addition, runs of Pacific and Klamath River Lamprey are significantly reduced. As indicated in Chapter One, declines in Pacific Lamprey (and other Lamprey species), Spring Chinook are significant, since the 1960s and 1970s.

Other foods for which access is denied or limited include candlefish, acorns, huckleberries, wild mushrooms, Indian rhubarb, watercress, wild turnips, mussels (several species, also known as "freshwater clams"), crayfish and deer (see Table 1 below).

The most extensive study of pre-contact fish consumption by tribes of the Pacific Northwest was

Table 1 Preliminary List of Traditional Foods for Which Access is Denied or Limited

"Common Name" and Food Type	Karuk Name	Latin Name
Aquatic		
Chinook Salmon	áama	Onchorynchus tshawytcha
Coho Salmon	ishyâat	O. kisutch
Steelhead	sáap	O. mykiss
Pacific Lamprey	akraah	Lampetra tridentata
Klamath River Lamprey	akraah	L. similis
Green Sturgeon	ishxíkihar	Acipenser medirostris
White Sturgeon		A. transmontanus
Mussels ("freshwater clams")	axthah	Anodonta oregonesis
		Gonide angulata
		Margaritifera falcata
Riparian		
Indian Rhubarb	káaf	Darmera peltata
Watercress		Nasturtium officinale
Wild Turnips		
Upslope		
Black Tail Deer	púufich	Odocoileus hemionus
Roosevelt Elk	íshyuux	Cervus occidentalis
Squirrel (Western Grey)	áxruuh	Sciurus griseus
Tan Oak	xunyêep	Lithocarups densiflorus
Dwarf Tan Oak	xunyêep	L. densiflora
Hazel	athithxuntápan	Corylus cornuta
White Oak	axvêep	Quercus garryanna
Canyon Oak	xanpútip	Q. chrysolepis
Black Oak	xánthiip	Q. kelloggii
Red Huckleberry	xánthiip	Vaccinium parvifolium
Evergreen huckleberry	púrith	V. ovatum

published by Gordon Hewes in 1973. Hewes used daily caloric and protein requirements and existing historical records to calculate pre-contact fish consumption estimates for several dozen tribes from Northern California to Alaska. Hewes used the daily caloric requirement of 2000 calories per day, the figure of 1000 calories per pound of salmon and estimated (conservatively) that half of calories came from salmon. This yielded a general figure of 365 pounds of salmon per person per year or about 1 pound per day. Hewes made a similar calculation for protein:

> Instead of basing our estimate on calorie demands we may take another minimal dietary requirement for protein. The daily protein intake of a normal individual cannot fall much below 60 grams without jeopardizing his health. Using 16 percent as the protein factor in salmon flesh (actually higher in the better portions) we find that 305 pounds per year would satisfy the native consumer if all or nearly all of protein were obtained from salmon. These two crude estimates are an indication of the order of magnitude of the total salmon and/or fish consumption of the area. Data indicate that the actual consumption of salmon by natives in some parts of the area were much higher per capita than we have assumed above . . . (1973, 134-138).

Hewes combined these ballpark estimates with historical figures and other information about each tribe to provide more specific figures. Hewes lists an estimate of 450 pounds of salmon per person per year or 1.2 pounds per person per day for the Karuk (see Table 2 below).

* From Hewes, Gordon 1973. "Indian Fisheries Productivity in Pre-Contact Times in the Pacific

Table 2 Estimated Present and Historic Fish Consumption

Estimated Historic Fish Consumption (Pre-contact)*

Population	Total for Tribe	Per Capita (pounds per person per year)
1,500	675,000	450

Estimated Present Fish Consumption from Tribal Catch (2003-4)

Population	Total for Tribe	Per Capita (pounds per person per year)
3,300	<1,000 fish	< 5 (average fish estimated at 15 pounds)

Estimated Present Fish Consumption from Tribal Catch (2004-5)

Population	Total for Tribe	Per Capita (pounds per person per year)
3,300	< 100 fish	< 0.5 pounds

Decline in Fish Consumption

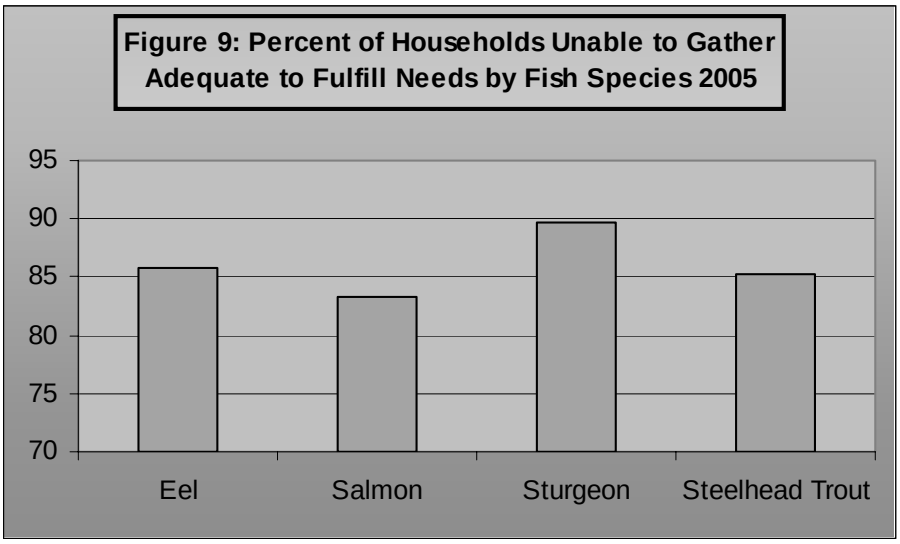
By 2003 the Karuk diet contained only 1.1% the amount of salmon consumed in "pre-contact' times. In 2004 this dropped tenfold again to 0.1% of the salmon consumed traditionally.

Salmon Area" Northwest Anthropological Research Notes 7(2): 133-155.

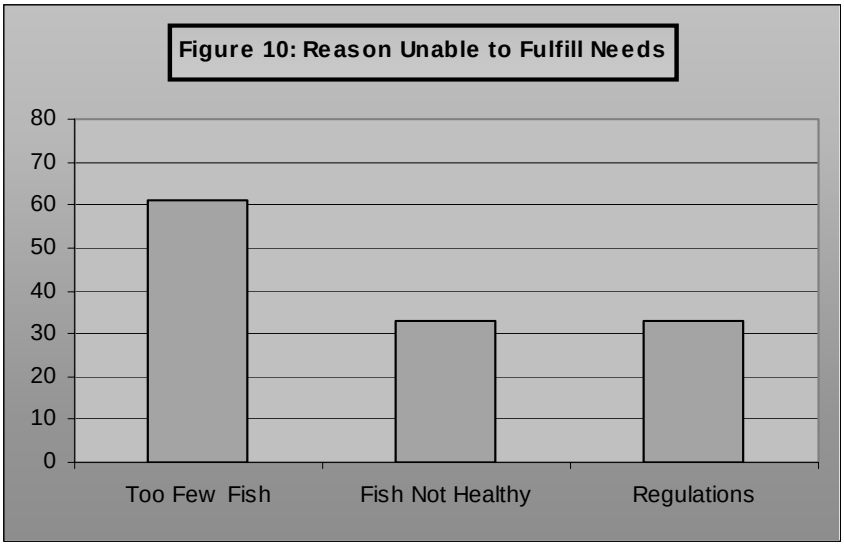
While it has been at least a generation or more since Karuk people ate the quantity of salmon Hewes reports, both the frequency of fish consumption and the percentage of meals that contain traditional foods has dropped drastically within the lifetime of most adult Karuk people today, as indicated in Figures 4a and 4b (from Chapter One). These graphs show that the number of people eating traditional foods once a week or more dropped from over 65% when they were teenagers to less than 25% in 2004. Similarly, the number of people who ate no traditional foods rose from less than 5% as a teenager to about 22% in 2004. For example, Marge Houston recounts the difference between her diet as a child and what people eat today:

> When I was young I ate acorns which was basically a staple. And of course they made their own flours and their own breads. But all the meat was taken off the mountains. Therefore, no steroids. No artificial food. So those people were healthy. They didn't have the heart problem because like I say the fish was available. I can remember as a child when we wanted one we went to the creek and speared a salmon or a steelhead and we had fresh fish for a couple days. And if we wanted some again well we went and got another one. But you can't do that anymore. For one thing, they're not there. Um-hm. It's sad.
>
> Marge Houston, Karuk Tribal Member

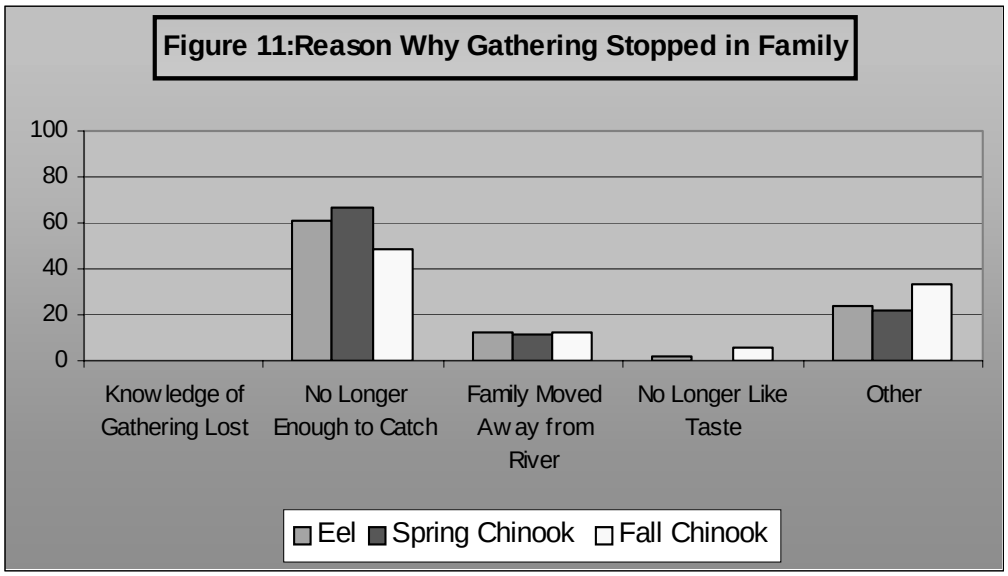
In order to better understand the reasons for diet shift, including the potential for other factors besides decline of species in the river, a number of questions on the Health and Fish Consumption Survey addressed intervening variables such as why gathering stopped and why consumption declined. The results of these questions point repeatedly to the decline of salmon in the river as the cause of diet shift (see Figures 9, 10 and 11 below). For example, tribal members were asked in the Health and Fish Consumption Survey why they no longer fished for several key food species. As indicated in Figures 9 below, the answer was overwhelmingly that there were not enough of the species available to satisfy needs (85% reported that there were not enough eels, 83% reported not enough salmon, 85% not enough steelhead and almost 90% not enough sturgeon).



Tribal members were next asked why they were unable to gather enough to fulfill needs. As indicated in Figure 10, the answers point to unhealthy riverine conditions and regulations.



When effort expended yields no results people may cease collecting food species. As indicated earlier for many species gathering in families has stopped entirely. Figures 6a, b and c from Chapter One indicate the time period when gathering stopped for key food species. Tribal members were also asked the reason why gathering stopped for each species. Results are presented in Figure 11 below:



The destruction of the resource base of the Karuk people and the absence of traditional foods has been accompanied by the substitution of government rations or commodities. Karuk tribal member and traditional Karuk fisherman Ron Reed describes the reason for denied access in the following way:

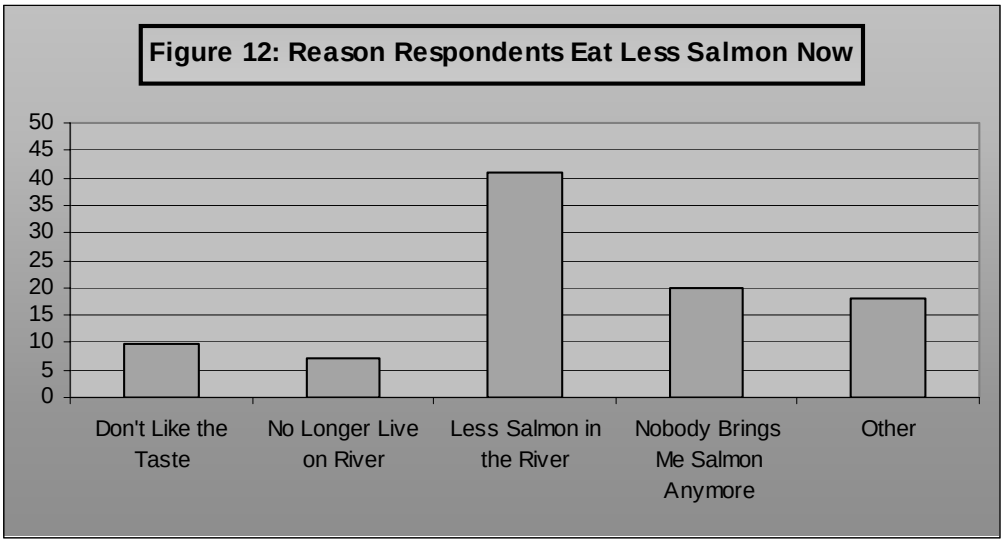
> A healthy riverine system has a profound effect on the people on the river. I have six children. If every one of those kids went down and fished and caught a good healthy limit like it was back in the 80's, you could pretty much fill a freezer and have nice good fish all the way through the year. But now, without a healthy riverine system the economy down here on the lower river is pretty much devastated. All the fishing community is devastated by the unhealthy riverine system. Instead of having healthy food to eat – fish– we are relegated to eating commodity foods that the government gives out. That's our subsidy: high starch foods, things that aren't so healthy that the Karuk people are pretty much forced to eat.

The conditions experienced by the Karuk reflect similar and widespread patterns of treatment of indigenous people in the United States, as medical anthropologist Brooke Olson makes clear: "During the past few centuries, many Native peoples have not only had their territories reduced or changed altogether, but they have also been given rations of lard, sugar, coffee, and have access to other such foods high in sugars and carbohydrates, which are deleterious to maintaining proper nutrition and weight . . ." (Olson 2001, 167). Food-rations programs have had problems from the beginning. As Yvonne Jackson notes in her historical review of diabetes, diet and health for Native

people, "unfortunately many problems plagued the rations program. As early as 1928 commodity or rations programs have been identified as problematic and inadequate" (Jackson 1993, 386).

Why Have Karuk Diets Altered?

The diets of all peoples and cultures change over time. This fact can be seen as "natural." For the Karuk people however, diet has shifted dramatically in the course of two generations through what can only be understood as very "unnatural" conditions. Forces working to shift the Karuk diet began with European contact. Genocide and forced assimilation over the past century have led to a loss of traditional knowledge of how to sustain a symbiotic relationship with the land (including managing for, and preparing and acquiring traditional foods), and a change in the tastes and desires of people. Yet despite these traumatic earlier events, the testimony of elders about foods they ate until recently indicates that the most damaging changes occurred within the last generation. These recent changes are largely due to denied access to traditional foods. Outsiders and some tribal members raise the issue of changes in people's taste for salmon, due to assimilation and changing individual preference. In order to address this Karuk Tribal members were asked why they eat less salmon now than as a teenager. While some tribal members report a change in their taste for salmon, only ten percent of survey respondents listed dislike of the taste of salmon as a reason for eating less salmon now than as a teenager. Reduced access was the primary reason for 70% of the respondents: 41% listed "less salmon in the river" and 30% listed "nobody bringing me salmon anymore" as reasons for the drop in their salmon consumption.



So called forced and voluntary choices concerning changing diet go hand in hand. For example, at the same time that the prevention of traditional burning practices has led to decreased habitat for tan oaks, the pressure to assimilate to the dominant culture's food tastes has led to decreased consumption of the tan oak acorns that are available. Overall, as Yvonne Jackson notes, " Contemporary food choices of American Indians reflect historical ties as well as many changes. A decrease in available variety and quantity of wild animals and plants parallels the loss of traditional lifestyle. Thus, although some individuals in some tribes still eat at least a limited amount of traditional foods, purchased items have generally replaced traditionally hunted, gathered or cultivated foods" (1993, 390).

Historical Influences: Genocide and Forced Assimilation

> "The years during relocation and establishment of the reservation system were very difficult ones for many reasons. Tribes had great difficultly adapting to the new life thrust upon them. Demoralized and disillusioned, the Indians suffered from malnutrition, disease and despair. Family life changed dramatically, as did the types of foods eaten and the ways of procuring and preparing foods"
>
> Yvonne Jackson in Diabetes as a Disease of Civilization 1993, p. 388.

Major shifts in the Karuk diet began during the gold rush, some 150 years ago. With cultural contact new foods might have merely supplemented rather than replaced traditional foods were it not for factors of relocation, forced assimilation and damage to the resource base by the direct and indirect activities of non-Indians. The arrival of miners, the military, and settlers into Karuk territory was accompanied by direct genocide in which many people and much knowledge of traditional foods was lost (Norton 1979). The presence of gold miners and others also restricted the supply of some food sources, including fish and wild game, although they did not initially destroy these populations. Furthermore, violent social dislocation, including the outright killing of three-quarters of the tribe, relocating villages, and attempts to move people onto reservations all interfered with everyday food gathering activities. (Lowry 1999, Norton 1979, Bell 1991)

A second factor influencing dietary change that dates from the time of European contact is the disruption of traditional land management techniques, especially practices of burning. White settlers and miners did not understand the role of fire in the forest ecosystem. Since the gold rush period, Karuk people have been forcibly prevented from setting fires needed to manage the forest ,

prolong spring run-off, and create proper growing conditions for acorns and other foods (Margolin 1993, Anderson, personal communication).

Disruption of these practices has led not only to decreased food supplies over time but the loss of traditional ecological knowledge. More recently, the rights of Karuk people to fish have been contested as well. During the 1970's the Federal government denied Karuk people the right to continue their traditional fishing practices (Norton 1979) by arresting them and even incarcerating them. Karuk fishing rights have yet to be acknowledged by the U.S. government.

A third historical factor behind the rapid shift in diet was the period of forced assimilation to the dominant culture through boarding schools and other institutional processes. Like youth from tribes throughout Canada and the United States, Karuk children were separated from families at young ages and taken to boarding schools in Oregon and elsewhere for the specific purpose of assimilation. They were prevented from speaking their native language and practicing their native customs and forced to eat a diet of "Western" foods. The result was that Karuk children were separated from traditional foods, often for years, and were unable to learn fishing, gathering, management practices and cultural ceremonies:

> One thing I do know that changed with a lot of the salmon too was all of the kids got shipped off the river to the boarding schools. My father took initiative and he learned the fishing part of his culture. His best friend didn't really catch the fishing part as much as he knows language and a lot of the ceremonial stuff. My dad never danced in a ceremony. Four years ago was the first time he'd ever danced, because he was beat for even trying to be Indian.
>
> Carrie Davis, Karuk Tribal Member

Not only was this generation of children denied access to their traditional diet, the foods provided were often inadequate even by Western standards. In her historical review of causes for the dietary shifts of American Indians, Yvonne Jackson reports that "A survey team in the 1920's reviewed 64 of the 78 Indian boarding schools and concluded that diet was the primary inadequacy. The schools were reported to serve large amounts of starch and meat but only small amounts of vegetables, milk, eggs and fruit. They recommended a marked increase in the quantity, quality and variety of food for all the Indian children" (1993, 388).

Today the assimilation of Native people to American mainstream lifestyles and food habits is being accelerated by an absence of traditional food (Olson 2001). The dramatic decline in eel and

salmonid populations that once supplied over half the Karuk diet has occurred within the lifetime of most adults alive today. Karuk elders and even younger adults describe extreme reductions in the availability of salmon and other important aquatic food sources:

> In the late fifties, early sixties there were numerous different types of salmon, and large like 50 pounds. I've seen salmon that weighed up to 70 pounds that people used to catch pretty regular but now you get a big fish, it's maybe 30 pounds. There's not the runs that there used to be. You had to be a pretty powerful fisherman even to catch them. At one time each fisherman would have a hole and they would get all the fish they needed. Nowadays we fish the whole river and we still don't get enough fish.
>
> Harold 'Littleman" Tripp, Traditional Karuk Fisherman

> I remember when I was 10 years old going eeling, there was a platform down at Boise Creek, all the eels that came out of that, I just couldn't believe it. And now we can hardly get an eel. And that was 60 years ago. There was eels…you could have any amount of eels you wanted. There was a lot then and they are almost nonexistent.
>
> LaVerne Glaze (quoted in Salter 2003, p.36)

> There ain't no eels. There used to be a lot of eels. There were so many eels that when they started swimming back the whole river stunk. There were so many dead eels that you couldn't eat hogs or bear that had been eating them. We used to see dead fish like we saw dead eels. They made their spawning process in the river and they died off. Then they floated down the sides of the creek.
>
> Earl Aubrey (quoted in Salter, 2003 p.36)

> There were fish there year round . . . [Now] we go to meetings and we argue about how many fish we're gonna get this year and how many fish are those guys gonna get. Well, they're not talking about fish; they're talking about fall Chinook salmon. End of list. They don't count, they don't bother to count; they don't fight or argue over any of the other species. Why? Not an issue, because they're not there.
>
> Leaf Hilllman (quoted in Salter 2003, p.44)

One dramatic indication of the loss of availability is the difference in the number of fish caught by father and son as young men dip-net fishing for the first time at Ishi Pishi Falls. Harold Tripp and his son Bill, both traditional Karuk fisherman, describe the number of fish each caught on his first day at the Falls:

> Harold (age 54): I started when I was 16, first time I dipped I caught 87 fish. But there was a lot of fish then, see, that would have been in '66. The river was a lot bigger and there was a lot more fish.

> Bill (age 31): First time I dipped I was just practicing behind Dad. It was the first day of Pikiavish, I asked Dad if I could fish before him. There wasn't any fish yet that year, they usually come in two months earlier, but they just weren't there. I threw it in there and I got one. I got the first fish of the year, the only one caught that day.

Causes of Denied Access

According to both Karuk observations and scientific literature, a number of factors either deny or limit the access of today's Karuk people to their traditional foods (see Table 4 below). Summarized in Table 4 are factors limiting food availability, organized according to where the foods are found: aquatic, riparian or "up-slope." The decline of aquatic species populations is due to decreased water quantity, high and low water temperatures, changes in flow patterns (due in turn to upstream dams), loss of spawning habitat, resource competition by non-Indians and the associated fishing restrictions. Riparian areas, both along the river corridors and creeks, are also impacted by decreased water quantity, increased temperatures and changes in flow patterns, as well as by logging and other up-slope activities. The abundance of plant and animal foods in up-slope areas has been reduced by the absence of controlled burning, logging practices, habitat loss from invasive species, herbicide use, resource competition by non-Indians and hunting restrictions. The increased growth of brushy

Table 3 Some Causes of Denied Access

Habitat	Example of Traditional Food	Causes of Denied or Reduced Access Include (but are not limited to)
Aquatic	Salmon, Eel Freshwater Mussels	Decreased Water Quantity Denied Access to Spawning Habitat Water Quality (Contamination) Changes in Flow Patterns Resource Consumption by Non-Indians Fishing Restrictions
Riparian	Indian Rhubarb	Decreased Water Quantity Decreased Water Quality Changes in Flow Patterns
Upslope	Acorns Deer, small game	Lack of Burning Logging Habitat Loss from Invasive Species Herbicide Contamination Resource Consumption by Non-Indians Hunting Restrictions

species limits physical access to foods that are available. In cases where species are accessible or even abundant, concerns exist as to food quality. Aquatic contamination of "freshwater clams" and crayfish by upstream fertilizers and pesticides is one example. Contamination of deer and other small game from forestry herbicides is another (Ando, et al 2003, Payne 1988), especially given the fact that forestry herbicide Garlon is not registered for use on food crops and has no drinking water safety limits. Garlon is the most frequently used herbicide in Humboldt County (Department of Pesticide Regulation 2002).

Altered River Temperatures

> The runs take their time coming up the river now, especially if the weather is hot. Last year was a bad year. We had more fish than we've had in a long time, but by the time they got to the falls they were at the point they normally look when they hit the dam. They were that sad. They were black, they were faded out. They were fighting the heat of the water. They were going from creek to creek, staying where the water was cooler, but they were traveling. They were in sad shape. The meat was almost white when it should have been red. Plenty of the fish died. The water was just too warm for them. When the water gets to where it is now, it's like a stale pond. The water is not getting the flow it should have. It has to have the flow. When it gets this low it doesn't have the oxygen it needs for the things that live in it.
>
> Earl Aubrey (quoted in Salter 2003, p. 36)

Lack of water in the Klamath River has led to increased crowding and spread of diseases, overall elevated river temperatures and the absence of the deep pools that serve as thermal refugia. Warm water affects salmon populations and indeed many species in the riverine ecosystem. Because it holds less dissolved oxygen, warm water is stressful (and ultimately fatal) for salmonids . In their Coho listing decision in 1997, the National Marine Fisheries Service found that "the most important cause of impairment of Coho Salmon probably is excessively high summer temperatures in tributary waters (National Academy of Sciences 2004, 7). "Causes of extreme temperatures include diversion of cold flows for use in agriculture, flow depletion that leads to warming of cool water and destruction of riparian vegetation that leads to loss of shading" (National Academy of Sciences 2004, 7). Furthermore water quantity in tributaries has also decreased, resulting in less flow into the main rivers.

> What I see is the water change. We just ain't got it. It's just not here. The springs that used to be here. The little creeks, the side lanes and all that's just all dried up. Even in the wintertime they're dried up. They will run water for a little time and dry up.
>
> Earl Aubrey (quoted in Salter 2003, p. 34)

Increased sediment run-off from upland areas into creeks and rivers leads to higher water temperature in streams. The presence of dams, logging, road building and the absence of controlled fire are also implicated in creating conditions that lead to extreme water temperatures. And siltation fills in deep pools that otherwise provide thermal refugia within the river systems.

> The vegetation protects the water. Wherever there's trees they do a great deal for the water because they give it the proper shade. They give it the proper habitat that it needs to keep flowing. Take that away from it-you got a little spring that comes out of the ground, it's running, sure, it's producing the same amount of water that it always did, but it hits the heat and the trees are all gone, the bushes are all gone. The sun sucks it all up.
>
> Earl Aubrey (quoted in Salter 2003, p. 35)

The National Academy of Sciences report on endangered and threatened Fishes in the Klamath River Basin found that, "Coho habitat has been seriously degraded in the tributaries. Lack of cover and impairment of substrate through deposition of sediment are common" (2004, 7) and that "Logging and its associated road-building have greatly increased erosion on the steep and fragile slopes of the watershed and have reduced shading of small tributaries, thus increasing water temperatures" (ibid, 294). Yet in the Spring water temperatures from the dams have been found to damage young fish because they are too cold, decreasing growth rates and thus overall survival (Kier Associates 2004).

Blocked Habitat from Dams

> The dams are stand alone as the ones responsible for the continued demise of all the fish species. Who could we blame for the demise of the eel population, the lampreys? We got no ocean fisheries out there catching them. White people don't catch them because they don't like them. Who is catching all these eels? Where are they going to? It used to be you could go down and fill a 55-gallon drum with them in half a night. Now you can spend a week down there at the height of the run, if you could figure out when that is – which chances is you couldn't because there really is no peak in the run anymore. You're lucky if you can detect when the run is anymore, let alone when the peak is. So what's responsible for their demise?
>
> Leaf Hilllman (quoted in Salter 2003, p. 45)

The series of dams from Iron Gate upriver block access of fish and other species to some 350 miles of spawning habitat in the "upper basin." This reflects approximately 90% of the spawning grounds for Spring Chinook salmon. Spring Chinook have been the most important food source for Karuk people and the salmon species whose decline is most visibly linked to the construction of the dams. The National Academy of Sciences report notes that "Barriers to passage caused by dams and diversions are important to Coho salmon. The mainstem dams on the Klamath river block spawning movements . . ." (2004, 7).

Changes in Flow Regime Due to Upstream Dams

The presence of Iron Gate and other upstream dams has also altered the flow pattern of the Klamath river. These altered flow patterns are reported to have impacts to fish and other populations by creating "side channel stranding" of juvenile fish and changing flood regimes.

> When I was young, the water flow would begin rising about two o'clock in the afternoon. This was due to the Copco Dams operating on a schedule of 12 hours on and 12 hours off. In this situation, Iron Gate helped the fish by evening out the flow, this helped out the spawning. With uneven water flows gravel bars would be exposed which trapped and killed young fish.
>
> Norman Goodwin (quoted in Salter 2003, p. 37)

> If you're raising this water every day then dropping it, you could go along the shore when you're swimming and you see schools of these little bitty fish, thousands of them all along the river banks. When this river raises every day, then drops these fish are caught because they are right along the shore where they are safe. These were baby salmon and steelhead. There was everything. I don't believe it really affected the eels because I've seen eels like in the sand, sandbars, y'know where the sand is wet. They would be in there. But these little fellows . . .they did it every day.
>
> Grant Hilllman (quoted in Salter 2003, p. 39)

Other tribal members have commented on the way in which changes in flood regimes due to the dams include increased severity of impacts on the river channel.

> Floods will always go on, but the impacts that they have . . . For how many thousands of years . . . you have a place like Katamin sitting there. You might say the place is unstable; that it is unstable around here. Not that slides never happened, I'm saying how many thousands of years of occupancy of these villages can we prove scientifically, about 4,000, if we'd let them dig a hole. And out of that 4,000 years

> there's probably been a few floods. And when did all of a sudden about half of Katamin disappear and go down the river? What flood did that? The '55 flood took a chunk, '64 took a huge chunk and even little high waters now threaten to take more. All the floods in the past 4,000 years didn't have that effect on it. The effect has only come about only since those dams have been in operation changing the river morphology, changing the characteristics of the river . . . In the 1700's floods that had water in much higher elevations than these recent floods did not have that effect. When the water receded the river went back to its channel. So you didn't have these catastrophic effects. Now if you have a flood, hell, the effects are catastrophic because of the way the river has been altered so dramatically that . . . the village site at Akins Creek. What I mean is the village site at Red Cap Creek, Katamin, Amikiarum . . . All the village sites I just named have had catastrophic effects from floods, but only since the Sixties. Prior to that '55 got it started, but you've had dams altering this river since before the Fifties. None of those things are coincidences so directly the dams have caused a tremendous impact, but indirectly they've caused a greater than tremendous impact.
>
> Leaf Hilllman (quoted in Salter 2003, p. 49)

Changes in the flood regime, including a lack of flushing that decreased water quality, are implicated in the recent Ceratomayxa shasta juvenile fish kill on the Klamath, as the progression of infection and mortality caused by C. shasta is temperature dependent. Furthermore, the California Department of Fish and Game has proposed that the shape of the lower Klamath river channel changed from 1997 – 1998 under the influence of high flows, the result of which was that fish entering the river were unable to proceed upstream under low flow conditions (National Academy of Sciences 2004, 8).

Decreased Water Quality

> We used to eat kaaf (Indian Rhubarb), and watercress. Now I'd be scared to eat watercress because you don't know where the water is coming from. And of course we had all the wild turnips. There were lots of crayfish. Now you don't see them any more. We used to eat freshwater clams too.
>
> Vera Davis (quoted in Salter 2003, p. 32-33).

Across North America, Native people face contamination of food sources (Chan and Receveur 2000, Kuhnlein and Chan 2000). Concern over contamination in the Klamath has prevented some Karuk people from harvesting aquatic and riparian food species. Species such as mussels or "freshwater clams" are of particular concern as these are "filter feeders." Freshwater clams are relatively abundant (although less so than in the past) but no longer consumed in quantity due to concerns over bio-

accumulation of materials in body tissues. Decreased water quality is thus considered a cause of denied or limited access to traditional foods both because it impacts aquatic populations and contaminates food species. Fertilizers and agricultural pesticides are used heavily in upper basin agriculture. Resident aquatic food species (i.e. mussels) and anadromous species that spend large amounts of time in fresh water (juvenile coho, summer steelhead and lamprey) are the most exposed to poor water quality conditions. It is appropriate that water contamination studies are being conducted under the FERC re-licensing process.

> These mussels here, my mom tells me that they used to have little patches, all the families would have their own patches of these mussels. They used to harvest them and manage them just like they managed everything else – only take a certain size and leave a certain amount to reproduce. They had these patches and through the years they just kind of disappeared.
>
> Ron Reed, Traditional Karuk Fisherman, 2004

The presence of high nutrient levels stimulate algal blooms that elevate pH and depress dissolved oxygen levels. Both high pH and water temperatures lead to un-ionized ammonia which is toxic to fish (California Dept. of Water Resources 1986).

> They hold the water back because they're trying to keep their water level in the reservoirs which cuts it short from going into the ocean. Then it just builds up and finally we get our weather and they say, 'Okay, we hit our level,' and they turn it loose. Then they open the gates and all we get is that slush and cow shit and debris from them reservoirs and it's pouring into our water and there is that white foamy stuff on the top of the water and this algae that is so thick you can't even walk in it and it's no good for the fish. It's no good for the wildlife. It's no good for nothing.
>
> Earl Aubrey (quoted in Salter 2003, p. 35)

The National Academy of Sciences report cites a combination of logging and fires as an important recent disturbance: "Logging and its associated road-building have greatly increased erosion on the steep and fragile slopes of the watershed and have reduced shading of small tributaries, thus increasing water temperatures" (2004, 294).

<u>Lack of Burning on Up-slope</u>

The practice of burning created good conditions for the growth of many important food species, especially tan oaks and manzanita. Furthermore, stands which had been burned were open enough for people to access them in order to gather. In the absence of burning over the past century brush fields have expanded and Tan Oak habitat decreased. Elders have reported that species such as huckleberries are present but not producing in large quantities due to shading (LaVerne Glaze, personal communication). The traditional practice of burning was beneficial for fish and other species in a variety of ways, as opposed to the catastrophic fires that have ravaged public lands in the Wester United States as a result of "modern" forestry practices. The National Academy report describes how large fires may have exacerbated the effects of logging in the basin. "Almost 30% of the [Salmon River] basin has burned in the last 25 years, and most fires have occurred in the logged portions of the basin. These catastrophic fires, coupled with extensive logging that follows fires ("salvage logging"), have greatly increased the number of logging roads and increased the frequency of landslides" (2004, 294; see also California Department of Fish and Game 1979, Elder et al. 2002).

Depletion of Resources by other non-Indian Cultural Groups

Karuk people are denied access to traditional foods due to direct competition of resource use by other ethnic groups. Whereas long standing cultural traditions existed for regulating and sharing fish and other resources both within the Karuk Tribe and between neighboring tribes, the entry of non-Indian groups into the region led to conflict and dramatic resource depletion (McEvoy 1986).

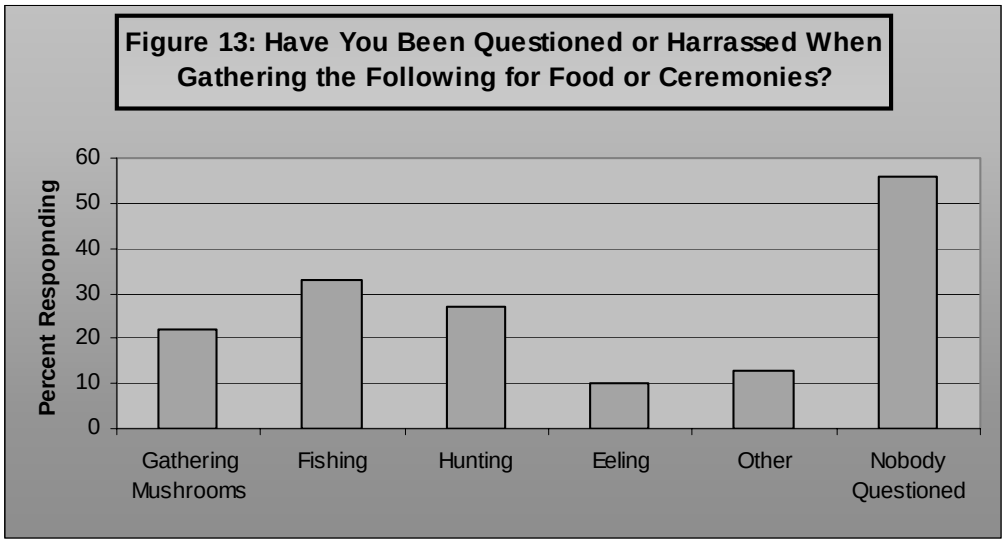
> We used to eat freshwater clams too. We used to get clams where we got our eels and fish in one little area there. There was more water in the creeks, now they are all drying up. I don't like people draining these streams for irrigation. I don't think people have a right to drain any stream or spring dry. There were fish in all of the big streams. Now there is no water in these creeks because of greediness. People taking all the water away from the river.
>
> Vera Davis (quoted in Salter 2003, p. 33).

Mushrooms are another important food source that has been depleted by non-Indian users in recent times. When Matsutakes mushrooms were "discovered" to be in the area, large numbers of people came to harvest them. Mushroom patches were significantly reduced. Patches that were within walking distance for Karuk elders were often destroyed first.

Regulation by Outside Agencies

> We had supplies from the river the year round. We hadn't been told that we couldn't get our fish any time of the year. That was put there for us by the Creator and when we were hungry we went to the river and got our fish.
>
> Vera Davis (quoted in Salter 2003, p.32).

A final overall reason for denied access to traditional foods is regulation by outside agencies – in turn a response to depleted populations that is controlled primarily by non-Indians. These regulations have often failed to take into account the Karuk as original inhabitants, their inalienable right to subsistence harvesting and and the sustainable nature of Karuk harvests. As a result they have attempted to balance the subsistence needs of Karuk people with recreational desires of non-Indians from outside the area (e.g. fishing). Vera Davis notes the imbalance and injustice of this view, "Now I don't think that no one has a right to tell us when we can do it when you have people who pay hundreds of dollars to come in, kill the venison and get the horns. I don't think that is fair because this is our livelihood." (Vera Davis quoted in Salter 2003, p. 32). Even more dramatic is the outright refusal of recognition of the Karuk fishery. In the Health and Fish Consumption Survey individuals were asked whether members of their household had been questioned or harassed by game wardens while fishing for a number of aquatic food species. As indicated in Figure 13 below a significant percentage of tribal members have had such experiences:



To be fined or have a family member imprisoned imposes a significant economic burden on families. This is a risk that many are unwilling or unable to take. Thirty six percent of survey respondents reported that they had decreased their subsistence or ceremonial activities as a result of such contacts.

Regulations affect not only fishing but also hunting, mushroom gathering and gathering of basketry materials. Tribal Vice-Chairman and Ceremonial Leader, Leaf Hillman describes this situation: "The act of harvesting a deer or elk to be consumed by those in attendance at a tribal ceremony was once considered an honorable, almost heroic act. Great admiration, respect and celebration accompanied these acts and those who performed them. Now these acts (if they are to be done at all) must be done in great secrecy, and often in violation of Karuk custom, in order to avoid serious consequences." As Hillman further explains it, government regulations force assimilation to the point of criminal indictment.

> In order to maintain a traditional Karuk lifestyle today, you need to be an outlaw, a criminal, and you had better be a good one or you'll likely end up spending a great portion of your life in prison. The fact of the matter is that it is a criminal act to practice a traditional lifestyle and to maintain traditional cultural practices necessary to manage important food resources or even to practice our religion. If we as Karuk people obey the "laws of nature" and the mandates of our Creator, we are necessarily in violation of the white man's laws. It is a criminal act to be a Karuk Indian in the 21st century.
>
> – Leaf Hillman, 2004

Tribal members were asked whether members of their household had been questioned or harassed by game wardens while gathering a variety of other cultural and subsistence items. As indicated in Figure 14, 12 percent reported such contacts while gathering basketry materials and over 40 percent while gathering firewood.

Twenty percentage of survey respondents reported that they had decreased their subsistence or ceremonial activities as a result of such contacts. To be fined or have a family member imprisoned imposes a significant economic burden on families. This is a risk that many are unwilling or unable to take. Denied access to traditional foods at the hands of non-native agencies has significant cultural and spiritual impacts as well. These will be discussed in Chapter Five. This chapter closes with a discussion of the specific circumstances of several key aquatic food species for the Karuk.

Spring Chinook Salmon

Of the many fish species Karuk consume as food, the Spring Chinook salmon have historically been the most important. Spring Chinook were harvested in signifcant quantity by the Karuk tribe until the 1970s and 1980s. It is the recent loss of this run that accords the Karuk the dubious status as amongst of the Native tribes whose diet shift has been most recent and most dramatic in the United States. Spring Chinook had the highest volume of fish, a reliable run, higher fat content, was in the best physical condition, tasted better, and came in the Spring, a critical time for food. Diabetes was rare in Karuk families before the loss of Spring Chinook as a food source.

> It's the Spring Chinook is the largest and most populous run of salmonoids in the Klamath system. As a result of that it was the species and the run that was relied upon most heavily by tribal folks throughout the basin in historic times. That was the run that the entire management of the rest of the basin and the rest of the fisheries was based upon – the management of the Spring Chinook – because that was obviously the first run of the year.
>
> Leaf Hillman, Karuk Ceremonial Leader and Tribal Vice Chairman

The particular importance of Spring Chinook salmon for tribes in the region is noted by early anthropologists (e.g. Gunther 1926, Rostland 1959). Swezey and Heizer note that,

> Those native populations to whom anadromous fish were either the most important or a major stable in the food economy almost exclusively inhabited river drainages in which the spring salmon run occurred . . . With the exception of the coastal streams south of the Klamath, it appears that the most important and productive fishing areas in Native California were those which could rely upon an assured and abundant early spring run of king salmon (1993, 304 - 305).

Swezey and Heizer also emphasized that the Spring Chinook runs were repeated events which rarely failed entirely. Spring Chinook Salmon were not only the most important food source in terms of abundance and nutritional quality, the Spring run is also the most recently declined. Although damage to Spring Chinook populations has occurred over the past 100 years, a drastic drop occurred in the 1960s and 1970s. Tribal members living in the ancestral territory were asked to identify the decade in which various food species were no longer gathered in their family or became an insignificant food source. As indicated in Figure 6a (Chapter One) for Spring Chinook salmon 64% of those responding indicated that gathering of Spring Chinook salmon either stopped or became an insignificant food source since 1970. This information corroborates anecdotal observation by non-Indian people and the

limited data from California Department of Fish and Game.

> They were fish everywhere. You wouldn't believe the amount of fish there was. But you could just walk up there and you'd see them everywhere. Salmon. It was neat.
>
> Harold "Littleman" Tripp, Traditional Karuk Fisherman

> Our salmon of course that's really gone down. It has gone down so bad. We just barely got enough this year. We do a Tribal Reunion and invite all the Tribal members. And we barely had enough. There were, I'll say ten years ago, we just had so much salmon. It's just really going down each year. You know. And there was times that the salmon was so bad that we had to buy it, commercially, and that's just not us. That's not our way. We don't believe in it. Or I don't believe in it anyhow. We've always had a lot of it. It was our main diet, I know, when I was growing up. And of course the eel. We eat eel too.
>
> Blanche Moore, Karuk Tribal Member

> Because there was nothing to go out to our usual hole and always get one. We actually hardly went any place else because even though we did get one there another one would take its place. We always had fish. If we wanted more than one then we got more than one. But they were there and we could see them. Whereas now, you know, I get extremely excited when I see a half-pounder try to jump this little falls out here. You know, I don't see the fish in here I did as a child. No. I don't.
>
> Marge Houston, Karuk Tribal Member

The loss of Spring Chinook runs accounts for the dramatic difference in fish consumption for people in their early 30's.

> "As I child I age salmon three times a day."
>
> Bill Tripp, Traditional Karuk Fisherman, Age 31

> Yeah, we had salmon every meal. Got tired of salmon. But we didn't have freezers so we had to salt salmon down. Big crocks of it. And we always ate salt-fish. Every meal. Salt-fish and boiled potatoes. Just meal after meal. I remember one of my uncles in the family, you know that one day a month when we got to eat steak or chicken or somethin'. He wouldn't eat it; he would eat the salmon. He'd reach over there and grab fish and leave the steak layin' there. I was thinkin' man, you crazy. . . We even made, she even made a fish chowder. Smell the house up for days but it was good. Yeah, that's all we ate was fish. Fish, fish, fish. And if we didn't have salmon we'd eat steelhead. I had an uncle that fished all the time. He'd catch like ten a day. And he'd give 'em away. He always caught more than we could ever eat.
>
> Harold "Littleman" Tripp, Traditional Karuk Fisherman

> It's changed a lot. I don't eat fish at all. Once in a while. People just don't eat it anymore. My grandmother, she canned like, 100, 200 quarts of it every year. Salmon. Salmon patties… still one of my favorites. Salmon patties. It's good. But I don't know how healthy those are because you add all kinds of stuff to them. Fish… we smoke a lot of fish. I still smoke a lot of fish. I just don't eat it as much. Mostly I give it all away. People are always wantin' it.
>
> Harold "Littleman" Tripp, Traditional Karuk Fisherman

Spring Chinook are specifically associated with sections of the river impacted by the Klamath dams, which block over 350 miles of spawning habitat – 90% of their historic range. Traditional fisherman Ron Reed remembers the fish that used to spawn in the section of river now blocked by Iron Gate dam, what was called the "Copco Run."

> We used to go down when I was young, about my children's age now, 4 years old up to 11 years old. We used to go down and club and pack fish out all day long, also during the end of the summer. So we used to do that quite a bit and, again, we used to harvest that what we call the Copco run. We used to harvest that fish. That used to be the fish we used to subsist e on because, basically, back in the day, the spring salmon was used for fresh meat and, in the fall, when it was utilized to process it and use it through the winter.
>
> Ron Reed, Traditional Karuk Fisherman

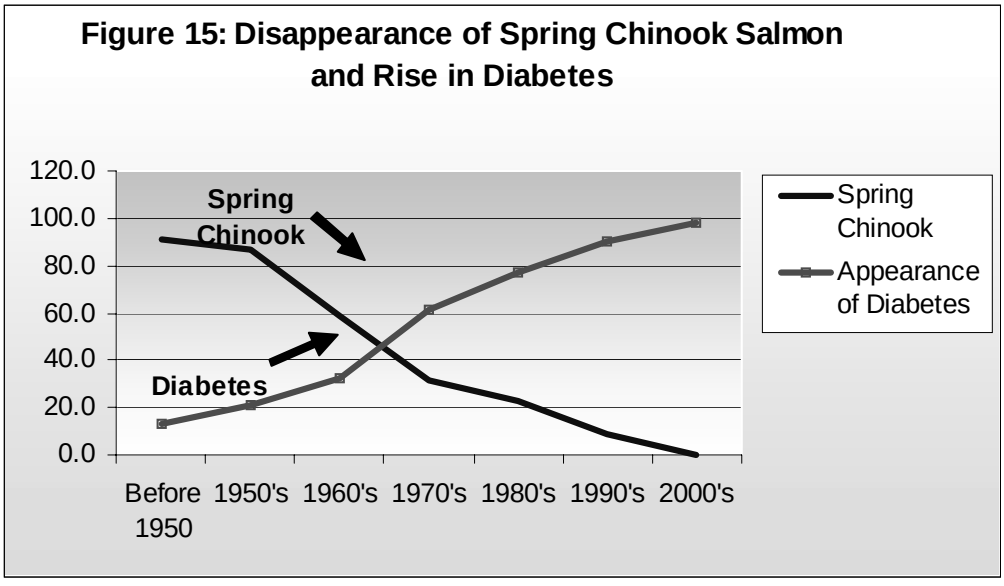
> It's pretty hard not to point the fingers at certain events, but when the spring run become nonexistent, the final straw in that camel's back was Iron Gate Dam. The last remaining habitat eight miles below Copco to Iron Gate was gone, and all the cold streams and all the spawning habitat. That small reach is gone now. That's the run that I used to, as a child, harvest that run before Labor Day. Now we don't even start fishing until after Labor Day. Well, we fish but we don't catch until after Labor Day. So those dams have tremendous impact on the spring salmon.
>
> Ron Reed, Traditional Karuk Fisherman

For the Karuk, Spring Chinook were the focus of the First Salmon Ceremony that was performed at Amikiaram. The Karuk have brought back all their ceremonies now except for one, the Spring Salmon Ceremony at Amikiaram. Ceremonial leader Leaf Hillman describes the importance of that ceremony, and the vital need for it to be performed again.

> With every species that we lose, that we no longer have access to, that doesn't help to sustain us, is another link that's broken. So it's vitally important to us… over the years, in my lifetime all of our ceremonies that our folks once did, every last one of

> them has returned with one exception. And how do you perform the Spring Salmon Ceremony, how do you perform the First Salmon Ceremony, when the physical act of going out and harvesting that first fish won't happen? You could be out there for a very long time to try to find that first fish and maybe you won't at all and then of course in the process you 'd end up going to jail too if anybody caught you. So, will that ceremony ever come back? Well, I don't know. But, once again, it's a link that's broken. And restoring that link is vital. It is a missing component. It's a resource that is missing from our people, it is missing from our culture, our religion.
>
> Leaf Hillman, 2004

Interestingly, it is the loss of Spring Chinook salmon that appears to correspond most closely with the rise in diet related diseases. It was during the 1960's and 1970's that Spring Chinook dropped out of the diets of most Karuk tribal members, and shortly following this event, that diabetes is reported in high numbers. Below is Figure 15, a modified version of information presented in Figure 8 in Chapter One, which illustrates a rather striking parallel between the self-reported emergence in diabetes in the Karuk tribe and the decline in Spring Chinook runs.



The relationship between loss of fish in the diet and diabetes is a correlation that may or may not be causal. The drop in gathering of Spring Chinook and the rise in diabetes rate could be happening by chance, or due to some other

outside force (such as people moving away from the river, or some dramatic event). Causality cannot be determined from the statistical analysis itself, but can be inferred from induction. The fact that Native people around the world experience skyrocketing rates of diabetes with the shift from a traditional to western diet, coupled with the fact that salmon the food lost by the Karuk people would be prescribed by a doctor as the exact ideal food as both preventative and cure for diabetes together with the close temporal association between the two events makes a very compelling case for a causal relationship.

"Eels" Lamprey Species

There are multiple species of lamprey in the Klamath river system. Lamprey are anadromous species who travel upriver to spawn and then die. Lamprey, or "eels" as they are usually called by Karuk people, once made up the largest biological mass in the river system.

Eel is an important fresh food source in the winter and early Spring, especially before the First Salmon ceremony when there was no other food available.

> They are a pretty important food source for us in the spring, you know. In between when you can start catchin' salmon and when you quit catchin' steelhead. During that spring moon you have to, April, you have to stop catchin' steelhead. And then there's a period there when you have to wait until the ceremony's completed to do, to catch the salmon. So… That right there is the time when the eels end of startin' to come through and then you have that food source from the River during that gap. And it's um… it's very important. And they're really high in oils and stuff too. They're probably… I imagine if you were half-starved all winter you probably… good, good for you. I know you can't eat a whole bunch of 'em. They might make you sick if you eat a bunch of them.
>
> Bill Tripp. Traditional Karuk Fisherman

Karuk people were able to trade with those harvesting eel at the mouth or to go down there themselves to "go eeling." Eel are high in fat content and many Karuk people, especially elders consider them a delicacy. Their populations are however declining rapidly.

> I still eat eels. I guess probably quite a few people still do if they can get 'em. Not many people can really get 'em anymore. I got forty last year. I had someone smoke 'em last year for me for half so I got twenty of them canned. They got eat up pretty fast. The kids really like 'em. They didn't last long. I remember about five years ago we were puttin' up about 150, 200 eels just in a week. Just go down there and catch 'em and clean 'em. It's a lot of work. And then smoke 'em. You gotta smoke 'em for three days and then can 'em. So you know just goin' out one night takes a week to get 'em all processed. If you could get that many, but you can't even get that many anymore.

Bill Tripp. Traditional Karuk Fisherman

Of all the species of riverine foods that Karuk people are denied access to, the decline of Pacific Lamprey or "eels" is the most recent. As indicated in Figure 6c in Chapter One, fifty percent of people responding to the survey indicated that gathering for eels stopped or became an insignificant source of food since 1990, and 20 percent indicated that the shift happened in their family in the last four years.

> I know that, to this day, my husband, my brothers, my dad, my uncles, they all take off to go get eels. They all get everything down there. They get frustrated because they can't get them anymore. They go and they try for them and they're not getting them. I know they still keep doing it, but I haven't seen them get very many in a long time. I remember having smoking eels. There would be smokehouses just loaded. One at my dad's going, one at my uncle's going. They'd be canning them. I don't think I've seen that since-- I must have been about ten the last time I've seen it like that.
>
> Carrie Davis, Karuk Tribal Member

> Eels. The eels is a serious, serious, serious problem today. When I was little, you could go up and down. Anywhere you go near the river at a certain time of the year and you could smell the eels ... When I was little, they would run a jet boat up the river. You would be standing over by the shore, and you could see all these little eels get washed up. Jet boats would be up all day now and you can't see any eels getting washed up. The eels are almost gone. I'd probably eat eels every day of my life if I could.
>
> David Arwood, Traditional Karuk Fisherman, Age 54

Oregon State University Master's student Robin Peterson conducted in dept interviews with Karuk and Yurok tribal members about lamprey during the 2004-2005 season. Peterson noted that one of the main factors mentioned as a reason for the decline of lamprey was the dams. Many participants mentioned first noticing a decline (albeit gradual at first) at the time that Iron Gate Dam was put in Peterson 2005). In sharp contrast to salmon, the non-Indian and scientific community have paid little attention to eels.

> They're disappearin'. I don't know why, persay. I know that every study that's ever been done on the Lamprey before we started doin' one was on how to kill 'em. Because of dams. They interfere with the turbines. And so, I don't know. I know that just since I was a kid, you know, we used to go down and catch as many as we wanted. And now you spend all season just to get enough for a barbeque for one

night. And, it's pretty bad.

Bill Tripp. Traditional Karuk Fisherman

Peterson notes that in addition to the high (beneficial) fat content of eel, the physical activity of eeling is also an important health factor. The main eeling areas upstream at the falls, where eels are harvested by hook, dip net, or grabbing by hand require the ability to navigate and balance on large boulders amid rushing and dangerous waters in the middle of the night. Once the eels are harvested, eelers must climb up steep slopes hauling their sacks of eel.

Eels are also harvested by Karuk people using baskets. Baskets made from both traditional and manufactured materials require strength to carry them down to the river's edge and to push them out into rushing waters to set them at precise locations in the river. Especially those baskets made from wire and bicycle rims (and when full of eels) require the ability to haul them up and out of the water; again an eeler must be able to also carry their harvested eels back home or to their waiting vehicle, which is usually parked away from where they set their baskets (Peterson 2005).

Peterson also recorded information regarding loss of eel in the diet and changes in health, life expectancy and social importance of eels as traditional food: "Many eelers and non-eelers mentioned how people are not living as long as they used. It was not unusual for a person to live well into their hundreds. Providing for these elders was a natural part of the eeling process. Some people have maintained this tradition, while others do not because they have not been taught to do so, choose not to, or because they are not able to harvest enough eel to be able to give them away. Many elders mention their intense cravings for eel, especially in the winter and early springtime; a number have not received any eel in years. Some have remarked on how changes in people's diets have also changed the body's ability to digest a high fat food, such as eel— for example gout is a common condition for many people in the area" (2005). These social dimensions will be discussed further in Chapter 5.

CHAPTER THREE:

HEALTH CONSEQUENCES OF ALTERED DIET

"For the past three centuries, extensive (and sometimes forcible) sociocultural changes have impacted on the lifestyle and culture of Native Americans. Each cycle of experience with non-Indians in each historic period has left an imprint on the health picture of American Indians."

Jennie Joe and Robert Young, *Diabetes As A Disease of Civilization*

- The loss of traditional food sources is now recognized as being **directly responsible for a host of diet related illnesses among Native Americans** including diabetes, obesity, heart disease, tuberculosis, hypertension, kidney troubles and strokes.
- Traditional diet has been found to be an important factor in **both the prevention and treatment of diabetes.**
- The estimated diabetes rate for the Karuk Tribe is **21%, nearly four times the U.S. average.**
- The estimated rate of heart disease for the Karuk Tribe is **39.6%, three times the U.S. average.**
- Seventy percent of tribal members over age 60 report having diabetes.
- Nutritional factors contribute to at least **four of the ten** leading causes of death for Native peoples.
- The CDC reports that **diabetes is associated with severe and costly complications** such as blindness, kidney failure, lower-extremity amputations and cardiovascular disease, disability, decreased quality of life and premature death that continue to affect American Indians disproportionately.
- Diabetes can be considered the smallpox of the 21st century.
- Diabetes has recently appeared in the Karuk Tribe. In the Health and Fish Consumption Survey, **sixty six percent of tribal members report that diabetes has appeared in their family for the first time since 1970.**
- The loss of the most important food source, the Spring Chinook Salmon run, is directly linked to the appearance of epidemic rates of diabetes in

The loss of traditional food sources is now recognized as being directly responsible for a host of diet related illnesses among Native Americans, including diabetes, obesity, heart disease, tuberculosis, hypertension, kidney troubles and strokes (see e.g. Joe and Young 1993, Olson 2001). Identified health consequences of altered diet for the Karuk people include high rates of Type II diabetes, heart disease

and hypertension. These health consequences stem from changes in the specific nutrient content of traditional foods such as salmon and acorns, as well as decrease in the physical benefits of exercise associated with their gathering. Mental, emotional, cultural and spiritual health benefits of eating and harvesting traditional Karuk foods exist as well. These will be addressed in Chapter Five.

Diabetes is one of the most significant of the series of diet related disease that has reached epidemic proportions in the Karuk community. A condition stemming from too much glucose (sugar) in the blood, diabetes usually begins with insulin resistance, a condition in which fat, muscle, and liver cells do not use insulin properly. People who are overweight or not physically fit are at greater risk for diabetes. The overall prevalence of diagnosed diabetes in the U.S. is 4.9%. In 2003 the Center for Disease Control (CDC) reported that the overall, age-adjusted prevalence for American Indian and Alaska Native adults was more than twice that of other U.S. adults (CDC, 2003). It is also important to note that American Indian women face diabetes and associated secondary conditions with much greater frequency than do men (Olson 2001).

Data presented in this chapter are from two sources: tribal medical records and self reported data from the Health and Fish Consumption Survey (sample size of 90 adults). See Methods in Appendix A for extended discussion of these sources. The presence of diabetes in the Karuk tribe calculated from tribal medical records in the Karuk Tribe is estimated at 21% – nearly four times the national average of 4.9 %, see Table 5 below.[1] There is also a high incidence of heart disease in the Karuk Tribe, estimated at 39.6% or nearly three times the national average. Self-reported rates of diabetes are similar to estimates calculated from tribal medical data. However self reported rates of other diet related diseases are significantly higher than reflected in tribal medical records. Both sets of figures are provided here.

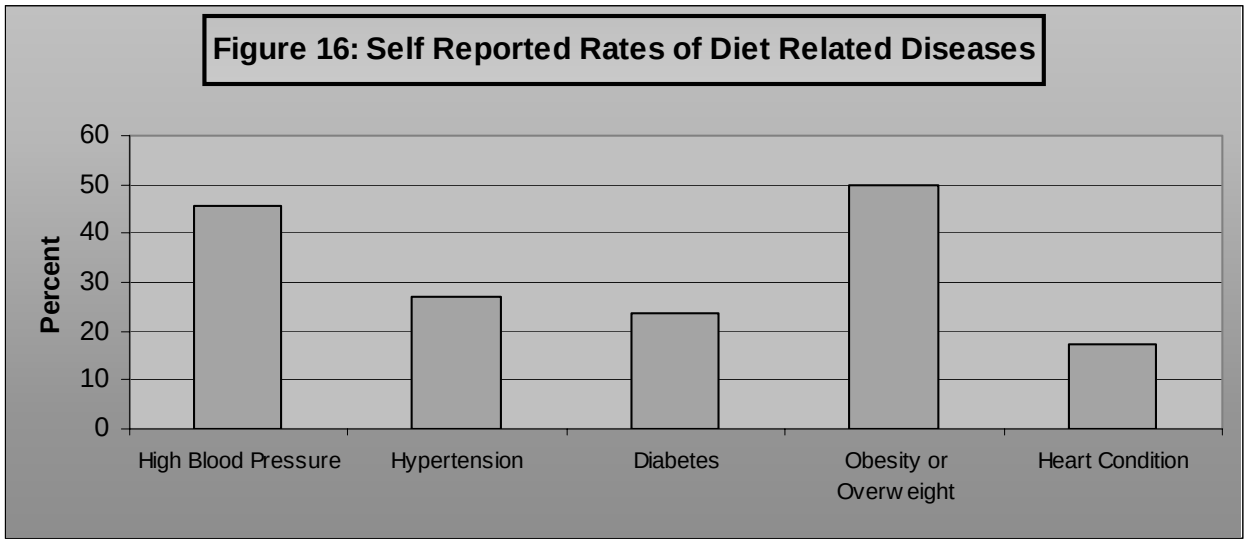
Table 4 Disease Frequency Karuk Tribe and National Averages

Condition	**Frequency in Karuk Tribe**		**National Frequency**
	Medical records	Self-reported	
Diabetes (Type II)	21.0%	22.8%	4.9%
Heart Disease	39.6%	16.2%	11.5%
Hypertension	35.7%	26%	32%
High Blood Pressure	10.3%	45%	32.3%

Data Sources: Karuk Tribe 2004 and CDC 2004.

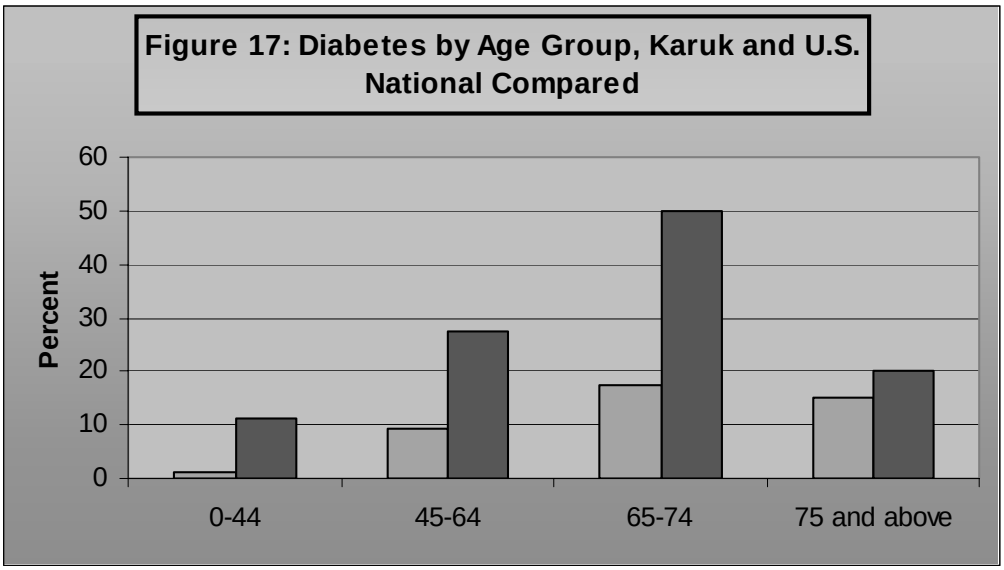
[1]For details on how rates have been calculated see Appendix A

Higher than average rates of cancers, kidney failure, strokes and other associated conditions in the tribe are suspected but not yet confirmed. Hypertension and hyperlipidemia (associated with diabetes) are among the top ten causes for visits to Karuk Tribal Clinics (Karuk Tribal Clinic 2004). The rates of these conditions in the Karuk Tribe are high with respect to both U.S. average and national averages for Native People.[2] Furthermore, with the exception of cardiovascular disease and cancer, the risk of death from most causes are higher among Native Americans than the total U.S. population (Young 1997, 147).



When broken into age categories, data from tribal medical records indicate that seventy percent of the population over age 60 has diabetes. Self reported assessments were similar. Self reported rates of diabetes were sorted according to standard CDC age classifications in order to compare with national averages, see Figure 17 below.

[2] Furthermore, it should be noted that clinical measures of diabetes will under represent cases. This points to the benefits of conducting a larger in-depth study. For example, in one study of the Navajo about one third of women with diabetes history used no medical therapy to control their diabetes (Will et al. 1997, 2106S).



Diabetes and other diet related diseases are serious health problems. They are difficult to keep under control on a daily basis.

> I can't eat honey. I can't eat bread. One bad thing about diabetes is that it's hard to get control of your sugar level again when you let it get out of hand. It takes days to get it back down. My eyes hurt all of the time. But then I get several heart problems and I got to take this damn medication that makes me feel like shit all of the time. Tired feeling and drugged feeling. I hate that worse than anything. So you got your heart problems and diabetes and you got all these damn problems and every kind of problem you got there's a whole list of foods you're not supposed to eat so it's hard. But what are you goin' to do? You got to eat. I eat something bad all of the time. Well, I guess if it was in a perfect world we'd all be eatin' fish.
>
> Harold "Littleman" Tripp, Traditional Karuk Fisherman

> I mean like I and my husband, we're both diabetics. We eat a lot of greens and a lot of vegetables, fresh vegetables. And we're feelin' a lot better. Whereas we keep eatin' meat, beef and stuff, then we just don't feel good. And I think that's because the fat in the meat too. But if we don't eat it we do feel better and we don't get as heavy. Because I guess the fat sticks around your heart and your heart has problems. And I've had two heart surgeries.
>
> Loreli Super, Karuk Tribal Member

<u>Diabetes and Life Expectancy</u>

> I've been to way too many funerals the last couple of years and that's not all right. That seems to me that they're just getting younger and younger.
>
> Ron Reed, Traditional Karuk Fisherman

One of the most significant consequences of diabetes is a decrease in life span. Although there are many stories of Karuk ancestors living to very old ages, even 100 years or more, numerous tribal members reported that, as Judy Grant put it, "They seem to be dyin' younger."

> I think people are dying younger too. I think it's the food. Because my husbands father was 91 when he died. Diabetes is what killed him and that's… when we were doin' research on the family a lot of the death certificates are from the diabetes. Most of them, almost all of them.
>
> Selma George, Wife of Karuk Tribal Member

Diabetes is the fifth-deadliest disease in the United States. More than 65% of people with diabetes will die of heart disease or stroke, and they are likely to die younger that people who do not have diabetes. Furthermore, studies indicate that diabetes is generally under-reported on death certificates, particularly in the cases of older persons with multiple chronic conditions such as heart disease and hypertension. Because of this, the toll of diabetes is believed to be much higher than officially reported. It was not possible in the course of this research to systematically document the causes of death for Karuk tribal members. However, in the health and fish consumption survey tribal members were asked why family members died and their age of death. Patterns were visible in the appearance of diabetes as a cause of death for a husband/wife or partner, and less frequently listed as a cause of death for a parent or grandparent.

Health Challenges Associated with Diabetes

High blood glucose is hard on the human body. The lengthy list of conditions that may be associated with diabetes includes cataracts, glaucoma and diabetic retinpathy leading to impaired vision and blindness, diabetic nephropathy which leads to End Stage Renal Disease (ESRD), increased frequency of cardiovascular associated diseases (including coronary artery disease, stroke, hypertension and lower limb vascular disease that may result in gangrene and lower limb amputation), increased susceptibility to infections, increased rates of periodontal diseases and increased rates of perinatal mortality – see Table 5 below (Gohdes 1995, Joe and Young 1993).

Table 5 Health Conditions Associated With Diabetes, Altered Diet and Poor Nutrition

Obesity
Type II Diabetes
Hypertension
Heart Disease
Kidney trouble
Glaucoma, Cataracts and other Visual Troubles
Limb Amputations
Strokes
Poor Dental Health
Decreased Life Expectancy
Increased Infant Mortality
Increased Spontaneous Abortions and Premature Births

Conditions associated with diabetes often manifest as severe and costly secondary illnesses and complications. Diabetes and these associated conditions are highly correlated with decreased quality of life and reduced life span.

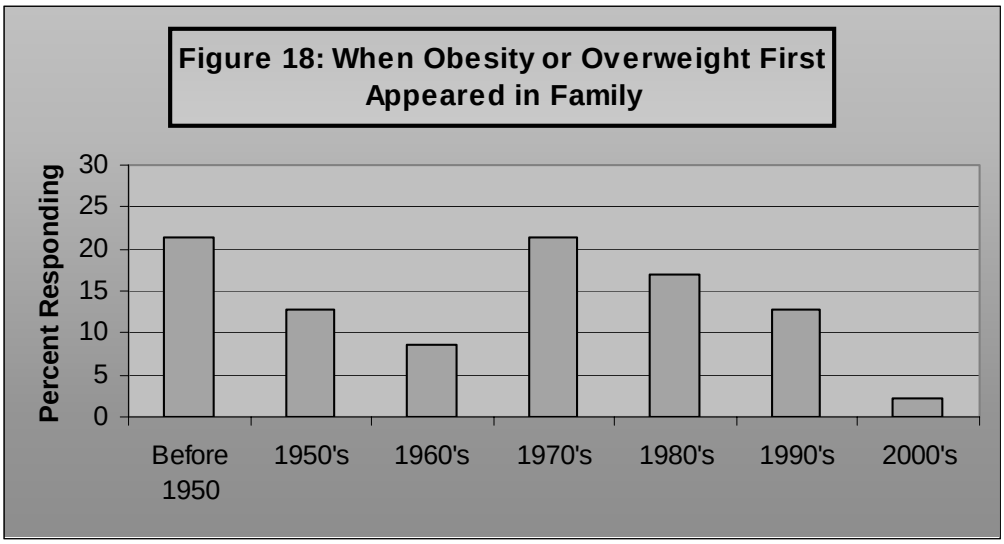
Whereas the risk of most of the conditions in Table 5 is increased by diabetes, obesity is significant because it is frequently a cause of the increase in the incidence of diabetes. Obesity is strongly related to altered diet (Howard et al. 1991).

Obesity has been linked with high blood pressure, cholesterol levels, difficulty sleeping, low self-esteem and poor performance in school. Recent studies on obesity and children indicate that poor performance in school may be linked to sleeping disorders. Tribal medical data on obesity place the figure at about 37 percent, a figure only slightly above par for the overweight American population. In the Health and Fish Consumption survey 50% of respondents self reported that they experienced obesity or overweight. Data from interviews indicate that Karuk people are heavier than they used to be:

> Anybody that's a nutritionist or has anything to do with that field, they come to this area and just take a look at the people and tell you that our people never used to be fat. Our people never used to have these health problems that we are encountering today. Diabetes is probably the biggest one but not the only one. The ramifications of the food that we eat and the lives that we live. High blood pressure is another one. I have high blood pressure. My mother had diabetes. I'm borderline, I'm pretty sure. You can certainly tell that our people never used to be fat. Now you can't hardly find a skinny person around.
>
> David Arwood, Traditional Karuk Fisherman, Age 54

> Well I know that people, back then, what I can remember when I was little… we didn't have all that much beef and stuff. We ate a lot of deer meat. And a lot of greens out of the river, creek beds. We'd get the greens out. And it just seemed like the people were not as heavy as they are getting any more. And I think that's more or less due to the things they put in the foods. Of course I'm not sure. But that's what I think.
>
> Loreli Super, Karuk Tribal Member

People often replace fat with high-density carbohydrates, starches and sugar. If a meal is accompanied by too little protein and fat, the stomach empties and food cravings begin. Survey data also points to a relatively recent increase in weight amongst Karuk people.



Tribal members report that it can be difficult to keep weight off when eating a Western style diet:

> I've always had, ever since I can remember, eating disorders, especially compulsive overeating. Two things that trigger the craving to overeat in me are white flour and any form of refined sugar: honey, corn syrup, white sugar, brown sugar, and so on. Its all crack as far as Im concerned - highly addictive and causing unpredictable mood swings. And white flour really isn't a food either, we could survive just fine without it, but its near and dear to the heart. In order to recover from the compulsive overeating, I've had to change the way that I eat and eliminate those kinds of foods. I can't help wonder if there's so much overeating and obesity and health problems just because of the sudden change in our diet and maybe not being able to adapt. And also the high rates of alcoholism, because I can't drink either. Before I quit drinking ten years ago, I had the same reaction to alcohol as I did to refined sugar - once I started, I couldn't stop.
>
> Susan Gehr, Karuk Descendant

In contrast several people note that acorns in particular are a very filling and satisfying food and that people who ate acorns do not seem to eat very much.

> That's what I was going to say about her dad. They used to tell us stories about when they grew up. I think he said they only ate twice a day. Fish and acorns. And that was what they got used to…He was always slender. Don't know how old he was. He was over a hundred. But he still, even after he moved out here, he still didn't eat much. He didn't eat much like we do (laughter). He would eat mush in the morning, or whatever, a little bit, and that's all he ate and then he was in the habit of not eating very much. So it made him healthy I'm sure.
>
> Robert Grant, Karuk Council Member at Large

> When I get to eat acorns, I don't need to eat very much food. In fact, if I eat acorns and eat a lot of other foods I feel just stuffed to the gills. And so I'm better off if I get to eat acorns just to eat… I don't need that much other food. A little bit of salmon, a little bit of other things. It's really a filling, kind of satisfying kind of food.
>
> Susan Gehr, Karuk Language Program Director

For virtually all Karuk tribal members the traditional diet has been replaced by store bought and/or commodity foods. Unfortunately, as Professor Harriet Kuhnlein, Founding Director of the Centre for Indigenous Peoples' Nutrition and Environment and others note "the market foods derived from plants that are available and used by families of indigenous peoples do not contain high nutrient density, but provide carbohydrates, energy, and nutrients through fortification" (Kuhnlein and Chan 2000, 617; see also Kuhnlein et al. 1994; Receveur et al. 1997; Morrison et al. 1995).

According to the survey, about twenty percent of Karuk people depend on food rations through government commodity programs. Significant concern has been expressed about commodity foods distributed to Indian people as a cause of obesity (USDA Food and Nutrition Service 1991) since the use of this program is high among Indian populations. Other studies have discussed the poor availability of high-fiber, low-fat foods in commodity food programs and called for change in these programs (Burhansstipanov and Dresser 1994).

Too much glucose in the bloodstream stresses the kidneys. Diabetes is associated with kidney troubles and after a number of years, high blood glucose can cause the kidneys to stop working. A chronic disease of increasing concern for Native American people in general is End Stage Renal Disease (ESRD) (Joe and Young 1993). In one study ESRD was found to be three times higher among Native peoples than among whites, while the incidence of ESRD due specifically to diabetes was six times higher (Newman et al. 1990). Estimates of frequency of various kidney conditions for the Karuk

Tribe are incomplete and more research is needed to establish the rate for these conditions within the tribe.

Another problem is that high blood glucose can cause nerve damage over time, causing people to lose the feeling in their feet or to have painful, burning feet. Nerve damage to the feet can lead to amputations because people may not feel pain from injuries or sore spots on their feet. Infections can develop which, if untreated, can lead to amputation. Diabetes can also lead to infections in the gums and the bones that hold teeth in place. In the absence of treatment, teeth may become loose and fall out.

Populations with high rates of diabetes also face the potential for high birth weights (infant macrosomia). For example, the Cree of James Bay have the highest ever reported mean birth weight and a high prevalence of infant macrosomia. (Rodrigues et al, 2000). High birth weights occur when the mother's blood has too much glucose. When this happens, the pancreas of the fetus produces more insulin in an attempt to use the glucose. The combination of high blood glucose levels from the mother and high insulin levels in the fetus results in large deposits of fat which causes the fetus to grow excessively large, a condition known as macrosomia. Given the high levels of diabetes in the Tribe, each of the above mentioned conditions are suspected to occur with abnormal frequency in the Karuk Tribe and should be evaluated. Diabetes researchers Joe and Young note that because of these secondary complications, diabetes is a costly disease not only in terms of medical care costs but also in terms of human cost. Of patients with Type II diabetes, 20 percent develop kidney disease, 45 percent develop cardiovascular related diseases and 50 percent suffer from hypertension. And the rates for these conditions are even higher for American Indian people (Joe and Young 1993, 3). The per-patient medical cost of diabetes will be discussed in Chapter Six.

> I've seen an increase in these diseases in my lifetime. My grandmother got diabetes when she was almost seventy years old, she started getting' it. And that probably has to do with her diet change. You know, she started changin' her diet she quit eatin', she didn't eat as many acorns. Didn't eat as much fish or not as much deer meat. No squirrels. Just quit eatin' all those things after stores moved into the country and stuff. Before that, you know, you had to provide for yourself. You ate what nature provided. Nowadays, seems like everybody, a lot of people have diabetes.
>
> Harold "Littleman" Tripp, Traditional Karuk Fisherman

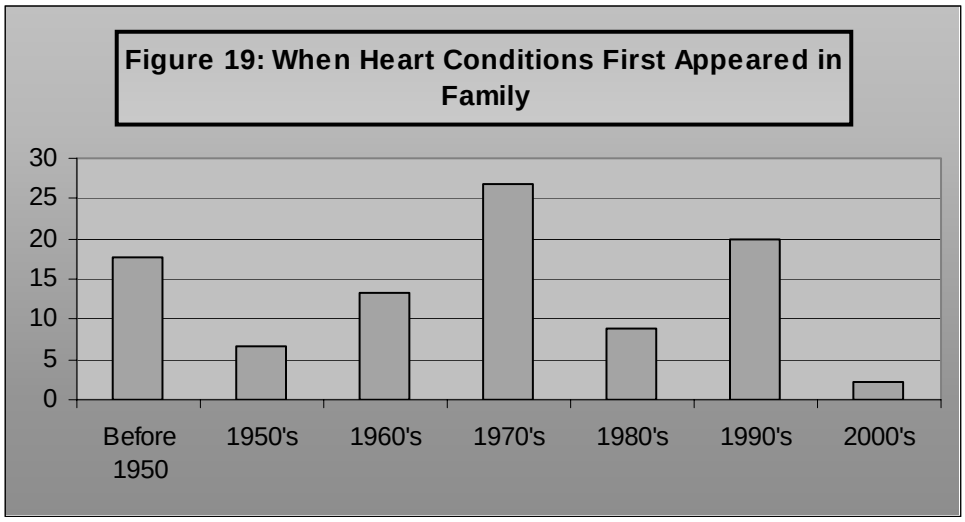
Diabetes is a Recent Disease

Despite their epidemic levels, diabetes has recently appeared in the Karuk population. Although

accurate medical records do not exist for the past century, self-reported data from the Health and Fish Consumption Survey indicate that conditions of diabetes, heart disease, and high blood pressure began to appear in most Karuk families in the 1970's. As shown in Figure 7 from Chapter One, in the Health and Fish Consumption Survey, sixty six percent of tribal members report that diabetes has appeared in their family for the first time since 1970.

> When did I first hear of diabetes? Well, wow…. I was married and had three kids before I ever heard about diabetes. And that was my nephew for that matter. He was telling me about it and he said that there's a lot of things that he can't eat or drink or whatever. And I said, "Well if you stick to this diet, will you get over it?" And he said, "Well I don't know." And then the next thing I know he's, I guess it affected his eyes and he almost went blind. And it was because of this. And I don't know, but, man, I'll tell you. It's a scary thing.
>
> Blanche Moore, Karuk Tribal Member

Other diet related conditions such as heart conditions are also described as recent occurrences.



Diabetes, Diet and Health

> "Diet plays an important role in the development of common disease among Northern indigenous peoples, i.e. heart disease, cancer, diabetes and iron deficiency. Diet may contribute to or protect from these diseases"
>
> – Ed Nobmnn et al. 1994, 123.

Nutritional factors contribute to at least four of the ten leading causes of death for Native peoples – heart disease, cancer, cirrhosis and diabetes – and the prevalence of overweight, obesity, hypertension

and dental cavities" (Jackson 1986). Much research shows that nutrient profiles of wild-animal and plant foods that were the basis of the Karuk diet until relatively recently are highly beneficial. Meats and fish are rich sources of energy, protein, minerals such as iron and zinc, omega-3 fatty acids, and important vitamins such as niacin and pyridoxine. Fats and unsaturated fatty acids are less prevalent in most wildlife meats than in domestic meats. Harriet Kuhnlein notes that "traditional food components of diets of contemporary indigenous people have been shown to be lower in fat and to contain less saturated fat than in the market food used to complement their diets" (Kuhnlein et al. 1991, see also Appavoo et al. 1991, Receveur et al. 1997). On the other hand, poor diet quality has been associated with higher incidences of anemia, ear infections, a variety of other infections and to some kinds of cancer (Kuhnlein and Receveur 1996).

Simple sugars have replaced much of the complex carbohydrates that were once present in the traditional diet. Furthermore, protein and micro nutrient content for important minerals has probably decreased, while fat content and calorie density of the diet has most likely dramatically increased. Dietary recommendations for diabetic patients generally include the reduction of total and saturated fats and an increase in complex carbohydrates (Howard et al. 1991), conditions present in the traditional diet of the Karuk (see Table 6 below). Thus, the Karuk traditional diet was not only useful as a preventative of diabetes, it is also an important treatment for this disease.

Table 6 General Nutritional Qualities of Traditional Karuk and Western Diets

Traditional Karuk Diet	"Western" Diet
Low saturated fat	High saturated fat
Complex carbohydrate	Refined sugars
High protein	High carbohydrate
High Omega-3 fatty acids	Vitamins and minerals must be fortified
Natural source of vitamins and minerals	

Karuk lore contains stories of ancestors warning about the unhealthy aspects of western food. In this story recounted by Karuk Tribal member Robert Grant Sr., bread was even called "poison" by some elders when it was first introduced by whites.

> I read about our people down in the Katamin area that when white people first came into the area they were brought bread. A loaf of bread. And old people told them that they shouldn't eat that because it was poison. And they said the half-breeds, well they didn't pay attention to the old ones and they started eating it and they said well it

> tastes good. It's sweet. There's nothing wrong with that (laughter) But the old ones knew that it was poison.
>
> Robert Grant Sr., Karuk Council Member At Large

While perceiving bread as poison may seem extreme and fanciful, the reality of the relationship of such foods to the health of the Tribe since that time makes the notion of breads as poison rather apt. Indeed given its epidemic proportion in the Karuk and other native tribes today, diabetes may be seen as the smallpox of the 21st Century.

Omega-3 Fatty Acids

One significant element of the high salmon content of the traditional Karuk diet is the presence of omega-3 fatty acids. Omega-3 fatty acids, a type of polyunsaturated fat found in salmon, are considered "good fats." Omega-3 fatty acids have been linked with a number of significant health benefits including reduced risk of heart attacks, strokes and Alzheimer, prevention of osteoporosis, a diabetic treatment, improved mental health and improved brain development in infants (see Table 7).
Some researchers believe that increase in prevalence of depression in the United States may be due to major dietary changes that have occurred during the past century, which have resulted in a decreased

Table 7 Potential Health Benefits of Omega-3 Fatty Acids

Improved brain development in infants
Improved mental health
Reduced risk of Stroke
Reduced risk of Heart attack
Reduced risk of Alzheimer's disease
Diabetic treatment
Prevention of Osteoporosis
Reduction of Triglyceride Levels

consumption of omega-3 fatty acids. A number of studies indicate beneficial effects of omega-3 fatty acids on various forms of depression, including one large-scale study that found a connection between people in countries that consume large amounts of fish and low rates of depression (Bruinsma 2000, Hibbeln 1998). Omega-3 fatty acids have been connected to other aspects of brain health in both adults and infants. Recent research finds that DHA, one of the types of omega-3 fatty acids found in salmon, is critical to normal eye and vision development in infants. Other studies indicates improved brain

development in babies whose mothers ate higher levels of DHA during pregnancy (Birch et al 1998). Finally, research indicates that consumption of fish once a week among people aged 65-94 reduced the incidence of Alzheimer's disease by 60 percent when compared to those who rarely or never ate fish (Morris et al 2003).

Not only are they believed to support brain functions, omega-3 fatty acids appear to be helpful in preventing heart attacks – a leading cause of death in for Karuk people. Recent Harvard studies found that several helpings of fatty fish a week – a prime source of omega-3 fatty acids – appears to protect men and women from heart disease. Furthermore, there is evidence that, at increased consumption levels, the presence of omega-3 fatty acids in the diet may dramatically cut the mortality rate of heart attack survivors and reduce incidence of coronary heart disease by 30 percent (Albert et al 2002, Hu et al 2002).

Omega-3 fatty acids may also be helpful for people with diabetes. People with diabetes tend to have high triglyceride and low HDL levels. Omega-3 fatty acids from fish oil can help lower triglycerides and raise HDL (Friedberg et al 1998). Other benefits appear to include reduced risk of stroke in women and prevention of osteoporosis. Omega-3 fatty acid intake may help protect against strokes caused by plaque buildup and blood clots in the arteries that lead to the brain (Iso et al 2001). Other studies suggest that omega-3 fatty acids help increase levels of calcium in the body, deposit calcium in the bones, and improve bone strength. A study by Kruger and co-authors indicates that people who are deficient in certain essential fatty acids are more likely to suffer from bone loss than those with normal levels of these fatty acids. Women over 65 with osteoporosis who were given EPA (eicosapentaenoic acid) and GLA (gamma-linolenic acid both are types of omega-3 fatty acids) supplements experienced much less bone loss over a three year period than those who were given a placebo. Many of these women also experienced an increase in bone density (Kruger et al 1998).

Traditional Diet in the Prevention and Treatment of Diabetes

Historical, comparative and experimental studies indicate the significance of traditional diets for both the prevention and treatment of diabetes in native populations. Diabetes is a 'new' disease among Native Americans, having developed from a rarity before World War II to an 'epidemic' in recent years. Although cases of diabetes did begin to appear with more frequency after the 1940's and 1950's, many groups did not see significant increases until after the mid-1970's, a situation that reflects the continued impact of Western lifestyles on indigenous American (Olson 2001, 165). Since World War II, Native people in the United States have lived more urban, industrialized and sedentary

lifestyles, and developed increased reliance on machines and store bought foods (Olson 2001,165).

To account for the rapid rise in the prevalence of Type II diabetes in Native populations, geneticist James Neel (1962) postulated the existence of a "thrifty gene." According to Neel's theory, early peoples existed through feast-famine cycles, and the thrifty gene would have had selective advantage because it increased the ability of the body to store fats (energy) that could later be metabolized during periods of food shortage (Joe and Young 1993, 5). The thrifty gene hypothesis is debated in the literature.

Whether or not a genetic factor is implicated in the high incidence of diabetes in Native populations, it wasn't until they adopted a "western" diet that the disease began to manifest. In a recent study, a high fat, hypercarloic "affluent" diet fed to a small group of Tarahumara Indians of Northern Mexico for 5 weeks led to weight gain and an increase in total and LDL cholesterol and plasma triglyceride concentrations. The authors of this study concluded that "a western lifestyle is associated with an adverse health profile and that the adverse metabolic consequences of modernization might be reduced if a traditional lifestyle is maintained" (McMurry et al 1991).

Similar results are seen for tribes in the United States. In a review of the historical changes in diet for the O'odham people, anthropologist Brooke Olson notes the "transition in foodstuffs from the eighteenth century, when Spanish missionaries introduced lard, beef and sugar, to World War II when the O'odham diet significantly shifted to a reliance on store-bought and commodity foods. Before this diet shift, diabetes was unknown to the O'odham people" (2001, 175). Studies of the Pima people suggest that the adoption of an Anglo diet may increase the risk of developing diabetes in Pima Indians (Williams, et al 2001). One study of the Pima people reports that "the Pima Indian diet of the last century was much higher in carbohydrate and lower in fat compared with the modern-day Pima diet. Any changes that this diabetes prone population can make toward their traditional diet may help to decrease their incidence of diabetes" (Boyce and Swinburn 1993, 369). In comparative work between two Northern tribes, Ed Nobmann and co-authors (1994) found that not only are Alaska Native diets are more "western" than are those of Chukotka Natives, their diets were more prone to higher cholesterol. Alaska natives consumed a greater proportion of kilocalories as carbohydrates and fat than Chukotka Natives. The authors found that "Coastal Chukotka Natives had lower average serum LDL cholesterol and higher HDL cholesterol levels than tundra Chukotka Natives, despite their high fat and kilocalorie intakes" (Nobmann et al 1994, 123). In another experimental study "a group of Aborigines with Type II diabetes who assumed a traditional lifestyle including diet for 7 weeks showed marked improvements in fasting glucose, insulin and triglyceride concentrations" (O'Dea 1984).

Other studies using traditional foods found improvements in glucose tolerance and insulin secretion with consumption of traditional foods. In their study to assess effects of traditional foods on lipprotiena, metabolism, insulin secretion and energy expenditure in obese and diabetic individuals, Howard and co-authors found that "In individuals having a wide range of obesity and glucose tolerance, substitution of complex carbohydrates for saturated fat has beneficial effects of lowering LDL cholesterol and possibly improving glucose tolerance and insulin secretion, but without having any adverse effects on lipoprotein metabolism or energy expenditure" (Howard et al. 1991, 786).

Amongst the more striking findings suggesting a correlation between the loss of the traditional diet and rise of diabetes within the Karuk population is the exact temporal match between these two events. Spring Chinook was the most important source of salmon in the Karuk diet in terms of both volume and nutritional quality. As illustrated in Figure X from Chapter One, self-reported information about when consumption of Spring Chinook salmon stopped or became an insignificant food source and when diabetes first appeared in Karuk families shows almost a perfect match, with the rise in diabetes following the loss of Spring Chinook in the diet.

Furthermore, elders within the tribe have successfully curbed diet related diseases by increasing fish consumption. Karuk elder Marge Houston experienced multiple heart attacks. But since dramatically increasing her consumption of salmon, her heart condition and cholesterol levels have improved significantly:

> You talk to a good many of the Karuk elders and they all have cholesterol, heart problems. I've had a six-way bi-pass. Two aneurisms and an arterial-femural bi-pass graft. I've been cut from stem to here. From here to here, in six different surgeries. I had my first heart problem in '95. My diet was basically Top Ramen, easy boxed, mixes. You know… chips, sodas, you know… Very, very poor. But now I eat good and my cholesterol has been under 200 for going on my third year. I ate salmon on a regular basis in the beginning when I found out how dangerous my cholesterol was. That's where I think the wild food is good. It makes a difference when I can have salmon or venison as opposed to a fatty beef or pork. Now my doctor says I have the numbers of a young person.
>
> Marge Houston, Karuk Tribal Member

Wild foods are healthier than processed store bought foods. Even meats and vegetables produced under modern intensified agriculture have less nutrient value than their wild counterparts. Karuk people still retain knowledge of specific foods to eat to when they are ill. Frank Lake describes the relationship between the nutrients in the forest and the nutrients in the birds and meat that come from the forest and is in turn consumed by people.

> When dad was sick, he really liked to eat Varied Thrush. So he'd go out and get those. And some Karuks ate robin. So those are things that people kind of do but don't do at all hardly anymore. And you think about what those birds, or even bandtail pigeon. What were they feeding on? Well, a lot of them were feeding on madrone berries, acorns, other nut crops. That's all internalized within their meat and protein that then becomes to the people at a secondary level. And so think about trophic level interactions. Again, if you're not taking care of the forest or the places that these wildlife like higher up vertebrates feed upon, then that doesn't become available to the people because, the environment can't support those species of birds and land animals, and then that doesn't become available to you as a food.
>
> Frank Lake, Karuk Descendant

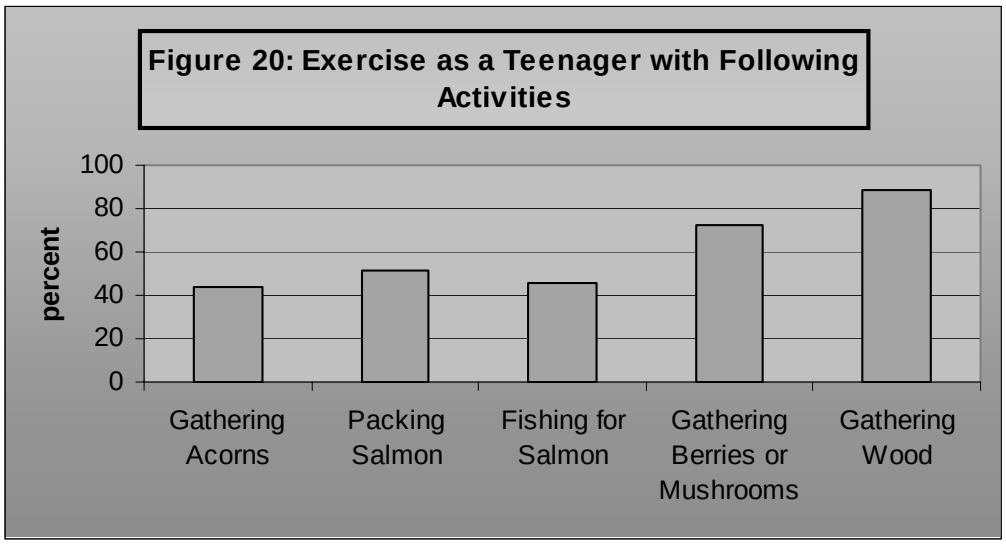
As Frank Lake describes, there is specific knowledge of foods and parts of foods that were most appropriate for young people and for older people too.

> There were so many different parts of salmon that were used. The main fillet going for stripping, the napes and the head old people love, because it's more cartilaginous. There's more fat. There's more oil, the bellies for them. Another part, you know, people, where they talk about the backbone meat being for babies because it has less bones and it's softer, more palatable. And with eels. People used to eat the nether cord, the back cord, and that was supposed to be good for old people's bones and for joints. …. Or cleaning the sturgeon. Some people, again, that long cord that you take out of it, people cut up, and use for a certain food again for older people like the eel cord.
>
> Frank Lake, Karuk Descendant

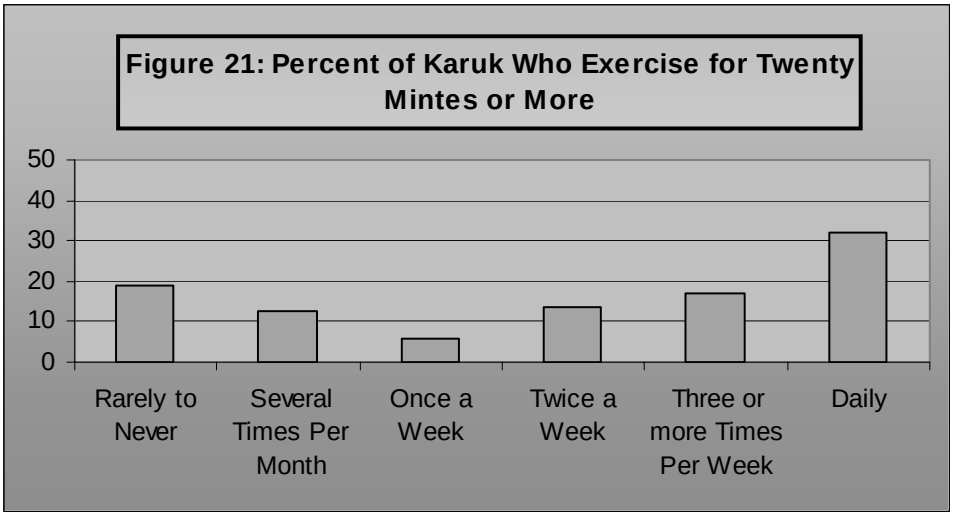
As with most indigenous knowledge, few examples of the health benefits of specific foods or parts of foods have yet been examined from a nutritional or medical standpoint.

Traditional Diet and Exercise

An important health benefit of traditional lifestyle is conferred in the act of harvesting of traditional food species. Hunting, fishing, berry picking and plant harvesting are activities requiring physical activity. Especially when they are part of regular activity patterns, these pursuits contribute to fitness and overall health (Kuhnlein and Chan 2000, 671; Kuhnlein 1992). Exercise is important for general physical health, especially for both the prevention and treatment of diabetes, and for mental health. Traditionally Karuk tribal members got a lot of exercise in the course of gathering foods. Nearly half of the survey respondents report getting exercise as a teenager by gathering acorns, or packing or fishing for salmon. Seventy percent report exercise gathering berries or mushrooms and almost ninety percent got exercise gathering wood, see Figure 20 below:



Although the amount of exercise that people get in the course of food gathering has certainly declined, half of those surveyed report engaging in the physical activity of gathering food now, although the frequency of such activity has certainly declined along with the decline in quantity of foods obtained. And while they are clearly more sedentary than is ideal, 51% of those who responded to the survey report that they engage in twenty minutes of exercise three times a week or more. Figure 21 shows that only 18% of tribal members surveyed say that they rarely or never engage in some form of exercise.



Lack of exercise is an issue of primary concern in the United States today. A recent study by the American Heart Association found that 37% of adults in the U.S. report no leisure time activity (AHA 2005). When compared with data on exercise in the U.S. population as a whole, Karuk people appear to be doing relatively well. While exercise has declined in the Karuk population relative to years past,

Karuk people do appear to be exercising more often than the U.S. population as a whole.

One of the primary alternative explanations for the increase in diabetes within the Karuk tribe besides the drop in fish consumption is a decline in exercise. Inadequate exercise no doubt contribute to the health crisis in the tribe. Yet it is interesting to note that triple average diabetes rates within the Karuk tribe are combined with higher than average reported rates of exercise. Thus, rates of diabetes and diet related diseases are higher within the Karuk tribe even <u>despite</u> higher than average rates of physical exercise.

CHAPTER FOUR:

POVERTY AND FOOD SECURITY

"Government policies have allowed natural resource extraction and development activities that have historically destroyed and currently threaten subsistence foods, traditional and modern small-scale agricultural practices and other food systems in North America, the Americas and all over the world, depriving Indigenous peoples of their basic human right to food security. Governmental policies and development activities often put Indigenous and local communities into a state of poverty, malnourishment and hunger."

Statement of the Indigenous Environmental Network on the Right to Food and Food Security, 2001

- Prior to contact with Europeans and the destruction of the fisheries, the Karuk people were **amongst the wealthiest** in what is now known as California. **Today they are amongst the poorest.** This dramatic reversal is directly linked to the destruction of the fisheries resource base.
- The devastation of the fisheries is also directly linked to the disproportionate **unemployment and low socio-economic status** of Karuk people today.
- **The destruction of the fishery has led to both poverty and hunger.**
- The United Nations recognizes the right to **food security** and **food sovereignty**.
- Poverty and hunger rates for the Karuk Tribe are amongst the highest in the state and nation. **Median income for Karuk families is $13,000**.
- The **poverty rate** for Karuk tribal members in Siskiyou County is **88.4-91.9%**.
- **25% of tribal members are employed but living below the poverty line.**
- **13.5% of families** live in either substandard or over-crowded conditions (2004).
- Difficulty in meeting basic needs results in overwhelming **physical and psychological stress.**
- **Replacement cost** of purchasing the traditional salmon diet that can no longer be harvested from the river would be **$4,000 per person per year or $13 million for the entire Karuk Tribe.**

Until quite recently salmon was both a primary food and the basis of the prosperous, sustainable economy of the Karuk people. Prior to contact with Europeans the Karuk, Hupa and Yurok tribes were the wealthiest people in what is now known as California.[3] Today they are amongst the poorest. This dramatic reversal is tied to the destruction of the fisheries resource base.

Lack of access to traditional food negatively impacts the Karuk Tribe not only because of the inferior nutritional content of replacement foods, but because the general absence or scarcity of food, maintains the Karuk people is a state of food insecurity. The devastation of the resource base, especially the fisheries, is also directly linked to the disproportionate unemployment and low socio-economic status of Karuk people today. Access to food and traditional food sources such as salmon are recognized as a basic human right by multiple international human rights treaties and by the United Nations, which specifically recognizes the right to food security and food sovereignty.

<u>"Salmon Feeds Our People"</u>

> "My gram and my mom and my aunt would fix fish all during the fishing time. They would pile it in baskets and keep a huge smokehouse going all the time."
>
> – Vera Vern Davis, Karuk Tribal Member, Former Karuk Council Member (quoted in Salter 2003, p. 33).

> "Growing up, I just remember seeing fish at the bottom of the refrigerator. I remember eating fish all the time to where we were sick of it. Kind of like all the time, all the time, all the time..."
>
> Ron Reed, Traditional Karuk Fisherman

> 'There are 3000 members in our tribe. Last year we caught 1000 fish. There's not enough to go around. We eat fish, so its kind of like we are obligated to get fish to our people, especially our elders, as many as they want. But they don't always get what they want."
>
> Harold "Littleman" Tripp, Traditional Karuk Fisherman

One of the more difficult aspects of the Karuk situation for non-Indians to grasp is the fact that before the dams, mining and over-fishing decimated their fishery, the Karuk people of present-day

[3] Kroeber, A. L. 1925. *Handbook of the Indians of California* cited in Arthur McEvoy *The Fisherman's Problem.* 1986.

California subsisted off salmon year round. In fact, Karuk people have experienced relatively high rates of subsistence living until quite recently. Tribal members in their sixties and younger recall their first visit to the grocery store:

> I can remember first going to the store with mom when I was about in the fifth and sixth grade and going in there and it was so strange to buy, you know, get stuff out of the store. Especially cans of vegetables, like green beans and stuff, Mom used to can all that. And bread. I was about six years old when I saw my first loaf of bread in the store. That was really quite a change, I'll tell you. But now you don't think nothing of it. I haven't baked for quite a while because all of my kids have gone away. I used to bake when they were home. I make a pie every once and a while, but that's it.
>
> Blanche Moore, Karuk Tribal Member

> I don't remember my mom always going to the store every night. I remember we drove to the store maybe every two weeks. We had to get what we wanted because that's what we got until the next time.
>
> Carrie Davis, Karuk Tribal Member, early 30s

These foods were both healthier and available outside of the cash economy. Most Karuk do not believe in buying or selling salmon. When asked in the Health and Fish Consumption Survey the majority of tribal members reported that they did not want to buy fish. Even if tribal members were willing to buy salmon, replacing subsistence fishing with store bought salmon would be prohibitively expensive.

> I remember one time we were up in a Safeway store in Oregon and my wife's Uncle had come from down river when they had a lot of fish and he enjoyed fish. And he seen this piece of fish and he told me, he says, "Let's buy that fish." It was only a piece about that big. He said, "Let's buy that. It's only $2.49." So I says, well, and I looked at it and I said, "No, that's $2.49/lb." He says, "Oh, I couldn't even digest it if I had to pay that much." (laughter) Yeah, that was a long time ago.
>
> Robert Grant Sr, Karuk Council Member at Large

Cost replacement analysis conducted in the Spring of 2005 puts the cost of purchasing salmon at over $4,000 per tribal member per year (Stercho, 2005). For the entire Karuk Tribe the annual total would be approximately $13 million per year (Stercho, 2005). In the communities within the ancestral territory this amount would represent over half of the average per capita annual income (see Table 9).

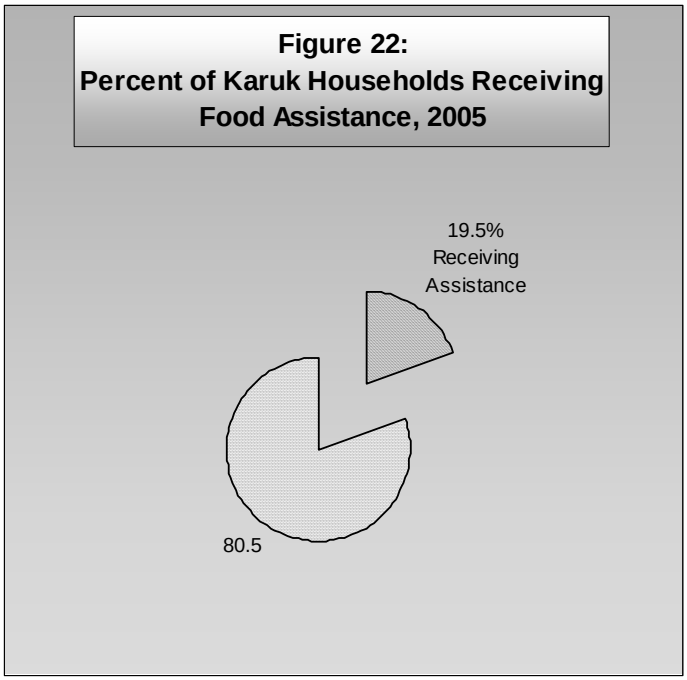
With denied access to traditional foods, a progressive switch from subsistence to store bought and commodity foods has taken place over the past two to three generations. Although Tribal members still report that they engage in subsistence fishing activities, with the destruction of the

salmon population, it is no longer possible for Karuk people to wholly subsist on their traditional foods. As a consequence, the number of meals that contain food from subsistence gathering has dropped significantly within the lifetime of most tribal members. As described in figures 4a and 4b in Chapter One, the percentage of adult tribal members eating traditional foods once a week or more has dropped from 65 percent when they were teenagers to less than 25 percent in 2004.

Salmon, eels, deer and other wild game were subsistence food. Although salmon was not bought and sold as part of a cash economy, the presence of this food meant that people didn't need to spend money buying other foods at the grocery store or be forced to rely on government commodities, as is now the case. In a recent report on the nutritional analysis of traditional and present foods, Karuk tribal member and registered dietician Jennifer Jackson notes the high cost of purchasing food at the local store.

> In addition to commodity foods, Karuk people must rely on foods available in grocery stores. On a limited budget, it can be difficult to obtain the freshest, most nutritious foods . . . There is a limited amount of nutrition education in the area, contributing further to the problem. However even with the proper education, it would still be difficult to obtain nutritious foods, as they are not readily available and may be out of the average Karuk family's price range. For example, the local grocery store in Orleans is lacking in variety and quality of fresh produce and other food products . . . In addition, the prices are high, making it financially difficult for a family to get adequate nutrition. The yearly median Karuk tribal income is $13,000 or ~ $270/week. Yet the average cost for a two-person family to eat healthy foods, based on the prices of foods available at the local grocery store in Orleans, is estimated at approximately $150/week. Note that this represents 55% of the income of an average family for the week! A high percentage of Karuk families are therefore dependent on other forms of income or food assistance, such as the commodity food programs. And thus the cycle of poor nutrition continues (Jackson 2005, 11).

Communities are defined as food secure when all members have access to nutritionally good, safe and culturally acceptable food through local non-emergency sources at all times. Recent U.S. Department of Agriculture studies show that while roughly 90% of the U.S. population is food secure, only 78% of Native Americans in the United States are food secure (US Dept Agriculture 1999). Figure 22 below shows that 19.5% of Karuk in the ancestral territory received food assistance. An additional 31 % of tribal members report that they would like commodities but do not qualify (2005 Health and Fish Consumption Survey). The replacement of traditional foods with store bought foods and government



commodities is not a straightforward matter in this remote region. Tribal members must drive up to 40 miles each way to acquire commodity foods and up to 80 miles each way to shop at supermarkets.

Given this information it is not surprising that recent data from the California Health Interview Survey conducted by U.C.L.A. show that Native people have the highest rates of both food insecurity (37.2%) and hunger (16.9%) in California (Harrison et al 2002). The California Health Interview Survey reports that rates of food insecurity and hunger in both Siskiyou and Humboldt Counties are high. For the Karuk people the issue of food security is fundamentally linked to the lack of salmon and other traditional foods. For the Karuk, food security has been an ongoing problem since European contact.

Poverty and Loss of Fishery Resource Base

> "For many millennia, the Indigenous peoples have developed and refined traditional sustainable agriculture, maintained hunting, fishing, and gathering practices, developed animal husbandry, all based on Indigenous and local knowledge handed down through the generations. These practices have enabled our Indigenous communities to achieve sustainability and food security - to adequately address hunger and nutrition - providing sufficient food year after year despite fluctuations in weather patterns and natural disturbances. By adhering to these practices, our Indigenous communities have been able to retain economic independence and self-sufficiency, and ensure that the diversity of plant and animal species remains high."
>
> – From Indigenous Environmental Network Statement on the Right to Food and Food Security, 2001

Although specific causes vary by region and history, the destruction of their resource base and separation of Indian people from the land has led to drastic poverty levels for Native people across the United States. Nationally, the poverty rate for Indian people is 25.9% (U.S. Census Bureau 2000). At nearly 90%, the rate for the Karuk Tribe is obviously much higher. In addition to the creation hunger and food insecurity, the depletion of the Klamath fisheries has lead to poverty for the Karuk people both directly through the loss of the economic resource base, and indirectly by forcing the shift from a society organized around subsistence to a society organized around the buying and selling of goods and services at the point when few such resources remain and the community is physically remote.

The 2004 poverty line for a household of four is $18,850. Poverty rates for the Karuk Tribe are difficult to determine precisely as high percentages of people are unwilling to offer this information (KTOC 2004). Regional poverty statistics provide background framework (see Table 9 below). In Happy Camp, Somes Bar and Orleans, communities that are within the tribe's ancestral territory and home to a significant number of Karuk people today, poverty rates are well above state and county averages. Census data on per capita income for Native people in these communities (most of whom are Karuk) are provided in Table 9 as well.

Table 9 Regional Poverty Rates and Percentage of Native Population

Community	% Native	Total Individual Poverty Rate By Community	Native American Per Capita Income
Happy Camp	24	22.9	9,683
Orleans	29	20	11,113
Somes Bar	25.9	32.6	6,215
Hoopa	81.7	36	9,221
Yreka	6.0	21.2	6,405
Siskiyou County	3.9	18.6	8,305
Humboldt County	5.7	19.5	11,532
California	1.0%	14.2	15,226

Source: U.S. Bureau of the Census, 2000

The poverty rates within Siskiyou and Humboldt Counties (ancestral territory of the Karuk Tribe and residence of the majority of the present population) are 18.6 and 19.5% respectively. These figures are much higher than the California statewide average of 14.2%. Furthermore, within the regions where the Karuk population is concentrated, poverty is much higher. Happy Camp, with 320 enrolled tribal members and their decendents out of a total population of 1,277 is 25% Karuk. Here the percentage of individuals living below the poverty line jumps to 22.9%. Similar results are observed for other communities in the Karuk ancestral territory including Somes Bar and Orleans (see Table 9). Census data show that extremely high percentages of the Native American population in each of these communities lives below the poverty line.

The Karuk Tribe gathers detailed data on income, employment and housing conditions for tribal members and decendents (KTOC 2004). These figures indicate that poverty amongst the tribe is significantly higher than for non-native people within local communities. While the median household income in Siskiyou County is $28,178, the median household income for members of the Karuk Tribe is $13,000 (KTOC 2004). The percentage of all Karuk households living below the poverty line in 2004 is between 80.1% and 85.0% (see Table 10). For Karuk people living within Siskiyou County the poverty rate is even higher: 88.4-91.9%.

Table 10 Percentage of Karuk Households Living in Poverty

Percentage of Total Karuk Households Below Poverty Line	80.1-85.0%.
Percentage of Karuk Households in Siskiyou County Below Poverty Line	88.4 – 91.9%.

Note the Poverty Line for a family of four is $18,8500 in 2004.

Source: Karuk Tribe of California Demographic Summary 2004

In the absence of either the subsistence fisheries economy or a thriving market economy, employment and unemployment are part of the picture of overall poverty in the Tribe. Unemployment rates within the Tribe are particularly difficult to assess as they vary according to source and calculation method. Furthermore, official unemployment statistics underestimate unemployment as they do not account for those who are no longer officially counted as looking for work (as occurs more frequently when available jobs are minimal or nonexistent). Table 11 reports official unemployment figures from several sources, as well as the percentage of people in the Tribe who are working out of the population considered 'available for work" (ages 18-65 but not students or disabled) – see Table 11.[4] The fact that a full 25% of Karuk people are employed and still living below the poverty line points to the low wages and insufficient availability of work in the region.

Table 11 Other Socio-Economic Conditions of the Karuk Tribe

Socio-Economic Indicators	
Unemployment Rate (Karuk Tribal Census, 2004)	26.5%.
Labor Market Information on the Indian Labor Force: 2005 Percentage of Population "Available for Work" who are Employed	47%
Labor Market Information on the Indian Labor Force: 2005 Percentage of Population "Available for Work" who are Not Employed	53%
Employed and Under Poverty Line	25%
Families Living in Substandard or Over-crowded Conditions	13.5%

[4] For more details on Unemployment Rate calculations see Appendix A.

Poverty statistics do not convey the true extent of hunger however, because hunger and food insecurity become issues significantly before individuals reach the actual poverty line. The recent California Health Interview Survey reports that 28.3% of Californians whose income was 200% of poverty level were found to be food insecure (200% of the poverty line is $37,700 for a family of four).

Poverty, Hunger and Health

Food insecurity is not only a major problem in and of itself, it poses a risk to well-being and long-term health (Harrison et al 2002, Margetts and Jackson 1993, Najman 1993). Young writes that "education and low income affect food choices and nutritional status and contribute to the development of chronic diseases, while unemployment engenders family breakdown and increases the likelihood of violence and injuries" (1997, 164). The U.C.L.A. Center for Health Policy Research reports that people who are food insecure have lower quality diets which in turn makes them vulnerable to a wide variety of diseases. Mental health risks such as anxiety emerge with food insecurity as well (Harrison et al 2002).

The health challenges associated with food insecurity exist across the life span. Information gathered in a recent child care survey indicate that 49.2 percent of children live in households with incomes below the Tribe's median income of $13,530 and almost fifty percent of children ages zero to five are living in households with incomes well below the poverty line (Karuk Tribe of California, Child Care Summary, March 30, 2005). Children in households with food insecurity have been found to do less well in school, have more absences, more frequent tardiness, more school suspensions and inferior cognitive functioning (Kleinmn et al 1998). Adolescents in homes with food insecurity exhibit more mental problems including depression and suicide (Alaimo et al 2002). A recent study found that food insecure elderly persons had significantly lower intakes of energy, protein, carbohydrates saturated fat, niacin, riboflavin, vitamins B-6 and B-12, magnesium, iron and zinc. In addition, food-insecure elderly persons were 2.3 times more likely to report fair/poor health status and had higher nutritional risk (Sun Lee and Frongillo 2001).

While commodity and emergency food supplies are available to supplement other sources, emergency food bags have been found to vary greatly in the amount of nutrients they provide (Jacobs, Gray-Donald and Kuhnlein 1999), and the food bank system has been criticized for providing limited nutritional support in a community (Riches 1989).

Loss of Traditional Food and Other Social Disruptions

> "American Indians and Alaska Natives are plagued by high rates of suicide, homicide, accidental deaths, domestic violence, child abuse and alcoholism as well as other social problems . . . We suggest that these social ills are primarily the product of a legacy of chronic trauma and unresolved grief across generations."
>
> – Brave Heart and DeBruyn 1998, 60.

Not only is the devastation of the economic resource base directly linked to the disproportionate unemployment and low socio-economic status of Karuk people today, difficulty in meeting basic needs frequently causes overwhelming physical and psychological stress (Harrison et al 2002). Food plays an important role in cultural continuity and identity – the loss of it accompanied by the severe socio-economic stress experienced by many Karuk families fosters alcohol abuse, violence, suicide, and other self-destructive and so-called "anti-social" behaviors. (Beauvais 2000, 110).

It is essential to understand the social and historical context for these conditions. Social workers Brave Heart and DeBruyn describe the history of Native people in the U.S. as an "Indian Holocaust," comparable to the experience of Jews in the Jewish Holocaust (1988). Such experiences of profound social disruption lead to despair which may manifest as depression, suicide, violence and other behaviors. Furthermore, in the case of Indian people, the experience of genocide has been denied, ignored and minimized within the dominant culture. This means that grief is "disenfranchised" – it cannot be openly acknowledged or publicly mourned (Doka 1989). Brave Heart and DeBruyn describe how "Disenfranchised grief results in an intensification of normative emotional reactions such as anger, guilt, sadness and helplessness . . . Further European American culture legitimizes grief only for the immediate nuclear family in the current generation. This may also serve to disenfranchise the grief of Native people over the loss of ancestors and extended kin as well as animal relatives and traditional language, songs and dances" (1988, 67). This issue will be discussed further in Chapter 5.

Food and Human Rights

> "Everyone has the right to a standard of living adequate for ... the health and well-being of himself and his family, including food, clothing, housing, medical care and necessary social services, and the right to security...."
>
> – Universal Declaration of Human Rights, Article 25

The right to be free from hunger and malnutrition is a fundamental human right of every woman, man, youth and child. The right to food is recognized as a basic human right under multiple treaties including

the Universal Declaration of Human Rights, the International Covenant on Economic, Social and Cultural Rights, the Universal Declaration on the Eradication of Hunger and Malnutrition, International Covenant on Civil and Political Rights, Rome Declaration on World Food Security and the Declaration of the World Food Summit (see Table 12 below). The powerful language of these treaties describe the situation faced by the Karuk Tribe as a clear violation of human rights. The right to food is also recognized in Article 1 in common of the International Covenant on Economic, Social and Cultural Rights (ICESCR) and the International Covenant on Civil and Political Rights (ICCPR) which states that all peoples, by virtue of their right to Self-Determination, may establish and implement their own economic, social and cultural development. It also states that, "in no case may a people be deprived of its own means of subsistence." The Plan of Action and the Declaration of the World Food Summit in 1996 states that Food Security is "the access of all people to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life."

Table 12 Food Security and Food Sovereignty as Human Rights

Human Rights Conventions on Food Sovereignty and Security
Universal Declaration of Human Rights, Article 25
International Covenant on Economic, Social and Cultural Rights
International Covenant on Civil and Political Rights
Universal Declaration on the Eradication of Hunger and Malnutrition
Rome Declaration on World Food Security
Declaration of the World Food Summit

The Indigenous People's Right to Food is also a collective cultural right, linked to ceremonial practices based on spiritual relationships with earth. Universal and sustainable food security is part of reaching the social, economic and human development objectives governments agreed upon at world conferences in Rio, Vienna, Cairo, Copenhagen, Beijing, Istanbul and elsewhere. The right to adequate food is also enshrined in legal terms in the most basic international human rights treaties, including the Convention on the Elimination of All Forms of Discrimination Against Women, the International Convention on the Elimination of All Forms of Racial Discrimination, and the Convention on the Rights of the Child.

In their pronouncement of the case of the Swas Tingni of Nicaragua, the Inter-American Court of Human Rights of the Organization of American States concluded "By virtue of their very existence,

indigenous communities have the right to live freely in their own territories; the close relationship of these communities with the land must be recognized and understood as the basis for their cultures, spiritual life, cultural integrity and economic survival. For indigenous communities, relationship with the land is not simply one of possession and production, it is also a material and spiritual element that they should be able to enjoy freely, as well as a means of preserving their cultural heritage and transmitting it to future generations" (9/17/01).

CHAPTER FIVE:

CULTURAL AND SPIRITUAL MEANING OF DENIED ACCESS TO TRADITIONAL FOODS

"For Indigenous Peoples, the collective right to food and food sovereignty are indispensable for the continuation of their cultures and Indigenous identity. The freedom for self determination of Indigenous Peoples involves not only access to but also control and management of their territories and natural resources."

Statement of the Indigenous Peoples at the Third Regional Consultation for Latin American and the Caribbean FAO and NDO/CSO Guatemala April 2004

You can give me all the acorns in the world, you can get me all the fish in the world, you can get me everything for me to be an Indian, but it will not be the same unless I'm going out and processing, going out and harvesting, gathering myself. I think that really needs to be put out in mainstream society, that it's not just a matter of what you eat. It's about the intricate values that are involved in harvesting these resources, how we manage for these resources and when.

Ron Reed, Traditional Karuk Fisherman

- **Diet change may lead to a loss of culture and identity. Traditional food is at the very heart of culture continuity.** When multi-generational family and social food gathering activities disappear an entire field of social relations is lost.
- **The present ongoing destruction of the resource base leads to further social disruption for Karuk people today.** Just as ceremonies surrounding fish create and maintain community ties and provide identity, so too does their absence and decline lead to further cultural disruption. **When elders die young they are not available to pass information and love on to the younger generations.**
- Worldwide indigenous knowledge of plants and animals is disappearing. Such knowledge is actively sought by medical researchers, ethnobiologists and pharmaceutical industries. **Although little attention has been paid to them, Karuk knowledge related to fishing and health is at risk of being lost.**
- **At stake with the loss of traditional foods, especially salmon, is nothing less than Karuk cultural survival**. Denied access to traditional foods must be understood in the broader context of cultural genocide.

Beyond its importance as direct subsistence and its specific health benefits, traditional food has great physical, cultural, religious and social values for Karuk people. Food has long been an integral part of

daily activities and celebrations. Hospitality and caring for elders are for example, important social obligations that involve food. The cultural and spiritual dimensions of salmon for the Karuk has probably received more recent attention than any other recent tribal issue (e.g. Salter 2003, King 2004). Existing documents provide in depth and critical testimony concerning the cultural and spiritual importance of salmon, eels, other fish species and the Klamath river itself. The emphasis in this final chapter will not be to repeat what has already been done, but rather to highlight the connections between cultural and spiritual aspects of traditional foods and human health. This chapter will address the social importance of salmon and other traditional foods as food. That is, the acquisition, preparation and consumption of food plays an important cultural and spiritual role for Karuk people. Furthermore, the absence of traditional food impacts social structure, cultural morale and mental well being.

Traditional Foods and Cultural Survival

> Back in the 1900s when the spring run was effectively cut off from the Upper Basin also began a dramatic decline in traditional values within the Karuk tribe.
>
> Ron Reed, Traditional Karuk Fisherman

Traditional food and food gathering activities are at the very heart of Karuk culture. At stake with the loss of traditional foods, especially salmon, is nothing less than Karuk cultural survival. The activities of managing, gathering, preparing and consuming traditional foods serves the functions of passing on traditional ecological knowledge, stories within the community and from one generation to the next. Food related activities serve as social glue that binds the community together, they outline social roles that provide a sense of identity and serve as the vehicle for the transmission of values.

That food is part of culture is reflected in the Karuk stories and language, which as language director Susan Gehr explains, contains at least one hundred fifty two words associated with salmon, another one hundred sixty two words associated with fishing and at least one hundred and twenty one words associated with traditional foods.

> I think definitely that our language is an important part of the culture. It is one thing that identifies us as how we are. Naming, having names for things, is really important. It's one of the things that establishes our sovereignty or the fact that we were here, have been here. We have names for things in Karuk. And we have names for things that are

> from this place. And we don't have names for creatures that aren't for around here, like buffalos and elephants, and… penguins and things like that. But we have bunches of names for coyotes and wolves and bears and all the things that are from around here. There are at least 152 words associated with salmon, another 162 words connected to fishing, ten more related to eels, and 121 words related to traditional foods.
>
> Susan Gehr, Karuk Language Program Director

In addition there are many traditional stories which pertain to food, including several stories that discuss the importance of sharing food with people including The Greedy Father, The Story of Slug and The Story of Skunk. There are also creation stories that establish the foods that Karuk people are supposed to eat, including stories about salmon, acorns, eel and deer.

Far from a luxury, native languages contain knowledge and are an expression of culture, identity and sovereignty. Karuk language has been declining for many reasons that are associated with changing lifestyles. When an animal or plant disappears from the ecosystem, or the activities associated with that species decrease, the associated words drop out of useage. Susan Gehr describes the impact of the loss of Karuk words for the people.

> People will forget those words or sometimes they won¹t remember the Karuk word for it. One of the things that happened is that there's not a lot of people who know the words for some of the different cultural items. Some people might look at language as sort of a luxury. Well, I mean like Maslow's hierarchy of needs, sure, you know if you're at the physical survival stage – you need a warm place to sleep and you don't deal with the higher level needs. They think that language is a higher need that we can or should take care of later. But the only people who grew up speaking the language in a household of fluent speakers are now elders, so we need to learn what we can from them now. There is no later. One of the things that establishes our identity as Karuk people is our language. And our stories. And the fact that we didn't always just speak English. We have a unique language and a unique grammar and a unique vocabulary to describe perfectly all the things that are here. There's a lot of Karuk people as hungry for knowledge of the language as they are for salmon and acorns, and feel just as badly over not having it.
>
> Susan Gehr, Karuk Language Program Director

Traditional fisherman Ron Reed describes "being Indian" as an activity. One's identity, world-view, values and knowledge base emerge from lived experience, from participating in activities that Karuk people have carried out for generations, from going through the world in relationship with specific places.

> You can give me all the acorns in the world, you can get me all the fish in the world,

> you can get me everything for me to be an Indian, but it will not be the same unless I'm going out and processing, going out and harvesting, gathering myself. I think that really needs to be put out in mainstream society that it's not just a matter of what you eat. It's about the intricate values that are involved in harvesting these resources, how we manage them for these resources and when. This knowledge is incorporated under our ceremonies.
>
> Ron Reed, Traditional Karuk Fisherman

The act of living in a traditional way, of harvesting and preparing and distributing traditional foods, leads to knowledge and imparts Karuk values of responsibility and relationship. Ron Reed describes how the activity of fishing is a forum for passing on both physical qualities, such as balance, and cultural tradition to his sons: "Fishing down at Ishi Pishi Falls you learn how to gain your balance. You learn the traditional values down there, the taboos and things like that, because it is a sacred fishery and there are certain rules that you abide by." These lessons are incorporated through the act of fishing for salmon:

> The children grow up, they're just going through life and living, but actually they're being trained at a very young age. You teach them how to go down and, first of all, just being able to walk down at the Falls. And the first issue is carrying them down there as a baby and getting them familiar with the Falls, and pretty soon, the next thing you know, they're walking. You take them down and let them go as far as they can. The next thing you know, now they're walking all the way down. Pretty soon, they're packing little jacks out. Now they're packing the salmon out. Now pretty soon, they're clubbing for you out there on the rock a couple of the fish that you're catching. Then all of a sudden, they're cleaning fish and packing them out and then actually giving them to elders and then learning how to process fish and learning how to gather the materials for your fish poles and how to do all those type of things.
>
> Ron Reed, Traditional Karuk Fisherman

<u>Traditional Food and Cultural and Ecological Knowledge</u>

> Worldwide indigenous knowledge of health properties of plants and animals is disappearing. Such knowledge is actively sought by medical researchers, ethnobiologists, pharmacudical industries, etc. Although little attention has been paid to them, Karuk knowledge related to fishing and health is at risk of being lost.
>
> Frank Lake, Karuk Descendant

Indigenous ecological knowledge is developed and passed along through practices of food management, harvesting and preparation. As families worked together information, and stories were shared. In addition to the transmission of knowledge, these stories provided a glue that held the family and community together.

> When you look at native cultures in California, especially with the Karuk, almost all activities that had to do with subsistence, or even ceremonies, were family focused. They were either families or extended family or with close friend groups or even by your village affiliation who worked together. When people used to go out, there was a division of labor. Women and the girls would do one thing. The men and boys would do another. Or maybe the elderly and the real young would stay together more at the main village, and the more able-bodied people would do the more laborious task. As a result you have a social component to it, you're exchanging information. You have this feedback loop. Young guys are out hunting together come back and tell the others: "This is what we saw here." "Oh, did you happen to notice this?" "Oh, yeah. It looks like there's going to be a really good crop of this coming pretty soon." So there was all this system of different people all across the landscape coming back for a ceremony or, during food processing times, telling stories and exchanging information about what was going to happen next.
>
> Frank Lake, Karuk Descendant

The presence of elders is "intellectual capital." They provide critical information about management that can be passed from one person to the next.

> So just by the nature of being out together, you have more eyes and more hands to do stuff, but then also too for your elders that are along with you are your more experienced gatherers, or hunters, or fishermen, whoever they might be. They can also share with you in the context of this situation to a whole range of others that were similar or even very different from that.
>
> Frank Lake, Karuk Descendant

> Being down at Ishi Pishi Falls with Karuk men, between doing dip netting rounds, there's times you have resting periods. And there's a lot of conversation that goes on there. It's time to talk about how nets were made, what was a net twining technique.
>
> Frank Lake, Karuk Descendant

A great deal of ecological knowledge is needed in order to obtain traditional foods – knowledge of techniques and also knowledge of the land. Anthropologist Robin Peterson describes the relationship between harvesting eels and traditional ecological knowledge: "As young people grow up living in and with the resources that are so much a part of who they are, they develop an innate understanding of the connections between resources as well as their own relationship with these resources—i.e., knowing when and where not to eel based on what is going on in the environment around you; understanding the rules that govern the taking of resources" (2005). Frank Lake describes the knowledge that is needed to make technology used to gather foods:

> In order to secure the food source, there's all other information that has to go into the materials or products or manufacturing techniques that go along with that. That's an

> important element with the traditional knowledge. If you're going to learn to make the dip net, you better know the right types of poles. So you have to have a certain understanding of the forest structure and forest density to give you nice Douglas fir poles. You gotta know something about the hazel that's going to be your loop. Traditionally, it'd been iris fiber or dog bane for your net. You'd have to know where to get that. So just in order to be a fisherman, you have to have a sense of geography of place with where all these other materials or resources are that you can acquire to be able to do that one job at that point in time.
>
> Frank Lake, Karuk Descendant

Knowledge of preparation is also important, much of this knowledge may be specific to the physical health requirements of young and old tribal members.

> People had learned through time, there was a specific need for these things. And then, even when you're starting to clean them, techniques of cleaning and preservation, even how there might be differentiation of the parts of a fish or eel to be used for different things. These go for these old people to be cooked up and boiled in soup. For these young ones, this part of it, we'll save the meat.
>
> Frank Lake, Karuk Descendant

Yet as food species disappear, or as tribal members are denied access to traditional land management processes, the particular knowledge of how to gather and prepare foods is also lost. Marge Houston describes how the appearance of a fern species is a sign that the eels will be running. She remembers also the gathering of freshwater clams or mussels as a child but does not know the specifics of how and when to gather them.

> Yeah, there, the eels are definitely a season. In fact, the one way my grandmother knew that they were running for sure was that there's a particular fern that grows and it grows in a triangle and she said that when those are up the eels are running. Because that fern is what they used to clean the eels because you could grip it with that fern. It gripped the eel because it's very, very slippery. Yeah, they knew. They were just like the mussels. They knew exactly what time of the year the mussels were edible and could be eaten. But, that I don't remember.
>
> Marge Houston

Other knowledge associated with food acquisition is still known, but only by a few people, such as knowledge of how to make the dip nets used for fishing.

> Another thing I hear recently they talk about is the dip nets. There's only a few people skilled in making them. It's all you hear people talking about, who are we going to make the net for? That's something that recently came up. A net got lost in the river. Somebody gives then $300 and says we lost your net. $300. Who's going to make the net?
>
> Carrie Davis, Karuk Tribal Member

In the fish consumption and health survey we asked tribal members the reasons why gathering had

stopped for four aquatic food species. It is indicative of the recent change in diet that "knowledge of gathering lost" was not a category selected by any tribal members as the reason why gathering stopped for any of the six fish species listed on the questionnaire[5] (see Figure 11 in Chapter Two). Yet if populations of salmon and other food species do not return, knowledge of the techniques of gathering these foods, along with all the associated ecological and cultural knowledge that is shared in the process of gathering and preparation, will likely begin to disappear.

Denied Access to Traditional Food: Social Disruptions

In addition to the loss of both culture and ecological knowledge, major social disruptions occur from the loss of traditional foods. Traditional food has an important place in the fabric of community life (Kuhnlein and Chan 2000, Kuhnlein and Receveur 1996, Usher et al. 1995). For the Karuk people the act of feeding a visitor in one's home is a serious social responsibility. Leaf Hillman, Karuk ceremonial leader and tribal Vice-Chairman describes the importance of traditional food and the cultural disruption that arises in its absence:

> Cultural practices such as feeding any visitor to one's home and the associated insult (that requires payment to fix) that results from the visitor's refusal to partake of food are still prevalent today among many Karuk families. These practices remain strong with many Karuk individuals and families, and also permeate traditional and contemporary Karuk gatherings of all types. It is a high order obligation and responsibility of every Karuk ceremonial leader/dance owner to provide food for everyone in attendance, at every meal or whenever they arrive in camp, throughout the duration of the ceremony. These cultural norms are also illustrated by the contemporary practice of the Karuk Tribal Council to feed anyone who is in attendance at every Council meeting. These practices reflect the continuing important role that food plays in Karuk culture and identity. Unfortunately, denied and/or limited access to nearly all traditional Karuk foods means that other non-traditional foods are substituted. Therefore, these cultural practices, in fact, contribute to many of the health problems experienced within our population and are detrimental to the overall well being of Karuk people.
>
> – Leaf Hillman, 2004

Traditional food is not only important as culture, sustenance and spirituality, it can also serve the social function of bringing families and the community together. Anthropologist Robin Peterson describes the social importance of eels:

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[5] These species were Eel, Spring Chinook Salmon, Fall Chinook Salmon, Coho Salmon, Sturgeon and Steelhead Trout.

> Eeling is an important time for families to get together. Eel roasts used to be common during the springtime, bringing many families together for socializing. Today there are not enough eel to have these gatherings anymore. Many eelers commented on how eeling gives young people something to do. However, when there are not enough eel to make it worth while for them to go then they look for other activities to fill their time. In a rural area, these "alternative" activities often include alcohol and drugs, as well as "getting into trouble." As more young people are placed in rehab or jail, the family structure begins to break down. Impacts also occur on an inter-tribal level, including the trading of resources, inter-tribal marriage, and participation in ceremonies (2005).

Frank Lake describes the centrality of food at social gatherings, describing food as "the glue or an adhesive that holds all the other social or cultural or spiritual activities together."

> And with the ceremonies, when people come together, someone will bring a deer, someone will bring acorns, someone will bring huckleberries, whoever happened to have some abundance to share or even gathered in mind to have for the ceremony. And certain get to be known for what they can bring. That, too, then becomes the reliance. So, again, the food becomes the glue or an adhesive, in many ways, that holds all the other social or cultural or spiritual activities together.
>
> Frank Lake, Karuk Descendant

Traditional food is also cultural capital in a subsistence and trading economy. When young people bring food to their elders they may be gifted with a story or other information in return.

> And with a lot of these collecting things, there were stories that went into tying you into the seasonality of what happened, what's going on with the habitat condition, some story about an ethic or conduct or way of behavior that was appropriate for harvesting that or for sharing it some way like that, kind of a social perspective of why you did it. And then also, too, the whole thing of it, knowledge. You're giving that prayer of thanks, that food resource, and then also acknowledging to it by speaking it out and saying the prayer formula, yes, I acknowledge you from the beginning of time that you are a gift here from the creator, and I'll share you with these people. And if you don't do that, you're literally not reciting that prayer, that thanks, or having that consciousness, then that means it's not done. And then that means that you're not taking that liver and some of that fresh young toe head buck meat to this little elder woman who, in all her glee and happiness, is going to have you sit down there and want to have tea or do something and is going to tell you a story. So then your payment, the retribution and the payment back for that is her form of knowledge of what had happened. Then that becomes your inherited, again, social capital that reflects from your value and your knowledge of accessing and managing for the ecological capital. And that's how I got a lot of knowledge. Make payment to the elder, and then they'll gift you with knowledge, and they see that you're trying.
>
> Frank Lake, Karuk Descendant

Stories about the land are important for the knowledge they contain. They are also important for the way they bring people together.

> If you don't have people out gathering, then stories about the land aren't being shared. Stories that share information and bring people together. It's like the difference between, "Where did you get the huckleberries." "Well, I was out with this and blah blah blah. . . This is how it was. I know this." So a story goes along with the food. Whereas if someone just went down and bought blueberries at Cotsco, like, "How was that Costco trip?" "Oh, town traffic was bad." Or it's like, "We don't have acorns, so thank goodness, we have this commodity flour." It's a conversation stopper.
>
> Frank Lake, Karuk Descendant

One thing that traditional dipnet fishermen emphasize is that fish is shared. Fishermen fish for the community.

> I had an uncle that fished all the time. He'd catch like ten a day. And he'd give 'em away. He always caught more than we could ever eat.
>
> Harold "Littleman" Tripp, Traditional Karuk Fisherman

The act of sharing food cements social relations with more distant relatives and friends up and down the river.

> I send eels up to folks up the Salmon River. And to different people who want eels, like most of the time I end up givin' to people but I always try to end up getting' enough to can too.
>
> Bill Tripp, Traditional Karuk Fisherman

Social relations are also cemented through collective activity. Fishing was not a solitary activity. Fishermen at Ishi Pishi Falls work together with clubbers and packers. These people are brought together in a unique relationship.

> They all go down there and take turns. All the ones that goes down to dip the salmon. They take turns. Not one person goes down there every day but they take turns. And usually they get out real early in the morning and they're out there all day. So they take their lunch down and water. And one of the things that they're really particular about is that they keep it clean. But no, it's just wonderful because they go down there and spend all day and people will just go down there just to watch them fish. And that's never seen it done before. And Ronnie's really good to explain to people what's happening and what they're doing and everything. And it's just really great. So, I don't know. It means a lot to go down there and catch a salmon and they have a elder sitting up there on top to be able to hand it to them you know. And, the only time that there is ever any money exchanged is that, "Okay. Here's five dollars and take it and buy

> gas." And a lot of them will refuse. And they say, "No. Take it you need gas money." So a lot of them does take it. It's jus wonderful down there. If you ever get a chance to go down there when the salmon, if we get salmon, when it starts running. Watch 'em jump and see how they dip them. It's really wonderful.
>
> Blanche Moore, Karuk Tribal Member

Other community members are drawn to the Falls as a place of sustenance, but also a place of stories and socializing. Carrie Davis describes the excitement of spending time with friends at the Falls when she was a child.

> It's a real social spot. You see people you might not see very often here. You know during salmon time, whenever you were fishing, you'd see them. I remember being excited because I may be seeing my friends every now and then, I would know that I'd get to spend the day with all those kids. I didn't get that chance all the time.
>
> Carrie Davis, Karuk Tribal Member

Fishing in this manner requires the support of an entire community or large family to pull the fish out of the water, club the fish and pack them up to the elders.

> But when I was younger, I remember all the elders being up on top of the hill, and they would bring food and different things for the fishermen. You didn't have to worry. They would fish all day, and you had plenty of packers to get up the hill, and you didn't have to worry so much about the kids, because there was always people around. But it's not like that anymore. The people who couldn't get to fish, I remember they'd just wait up top. They'd just take them out. My dad and my uncle are real upset nowadays, because when they catch it, they can catch some-- When they do get a good chance to catch some, they usually have to catch them and pack them and do all the work. So it's hard on the fishermen. So it was you'd get less and less.
>
> Carrie Davis, Karuk Tribal Member

Not only is the fishing at Ishi Pishi falls important as a time of people gathering and telling stories, fishing is a community effort, with different people there to do different tasks from dipping to clubbing and packing the fish up the hill to where people were waiting to receive them. Ron Reed describes how as the fishery declines there are fewer people there. Scott Quinn describes how it is hard for just a few fisherman to make the system work.

> There's a lot less people now on the river. Before you had a whole family. You had your brothers and sisters. You had your kids. You had your grandparents and the fishermen who catch it, then the clubber would who pack it back and clean them, pack them up the hill, tand ake it back to the family, and the wife would can them up. You'd smoke them and can them up. It's so few people now being able to have a job and be able to live on the river. It's really getting hard to process fish. It's a lot of work.

Scott Quinn, Karuk Tribal Member

Thus a cycle ensues as the fishery declines the community stops showing up for the fish, in turn making it harder for those who are fishing to get fish from the river to tribal members. Both the physical and social resource is lost.

> I think people come down to the Falls because they know there's something to come down to, and this year was awful quiet at the Falls because they also knew there wasn't anything to come down to, because they're [the salmon] never here.
>
> Ron Reed, Traditional Karuk Fisherman

Similarly, when people no longer work together in the forest, relationships between elders and youth are lost.

> I think the importance of it is is to be able to connect the younger children to the older generation, because when we're out there back in the day gathering honey and fishing, and that was pretty much a full-time job, and so the elders were left in the village with the children to be able to make that interaction, to be able to give them the strength and wisdom and things that are necessary to carry on in everyday life. So nowadays, what we've done is basically, we've moved away from those interactions because those food gathering activities are no longer taking place. The acorn picking is very small due to the fact that there are not very many acorns. Fishery, same thing. Medicinal plants. Other gathering, same thing. So nowadays, when we do it, the social aspect is kind of leaving out the younger generation. The older generation is kind of like-- The younger generation is sitting there watching the parents have interaction with elders rather than the parents watching interaction between the elders and the youngsters. So there's one component that's really missing here is the component between the elders and the youngsters.
>
> Ron Reed, Traditional Karuk Fisherman

As these multi-generational family and social food gathering activities disappear, the food disappears, but also an entire field of social relations is lost.

Traditional Foods and Social Roles

Ceremonies surrounding fish and the more everyday activities of fishing, eeling and gathering mushrooms and huckleberries also create and maintain community ties and provide identity. The activity of fishing provides an opportunity for young boys to spend time with and learn from fathers and older members of the community. Learning to dip net fish also serves as an informal rite of passage as boys begin early with easier tasks and move through a sequence of skills on their way to

dipping fish. Harold Tripp describes how "you start out by packing the dipper's poles, and then you work your way up to clubbing salmon for the fisherman and packing fish, and then you start dipping, if you can get in there." The practice of eeling is also connected to what anthropologists call rites of passage. Robin Peterson describes how,"While eeling, young men learn songs and dances from the older men, as well the right way to be Karuk men. Many go down to eel at a very early age to spend time learning how to watch, listen, and respect the seriousness and danger of the activity. It is not until they are a number of years older that they are finally allowed to use a hook to eel (2005)."

The lack of traditional foods makes it impossible to engage in social activities surrounding the gathering, preparation or consumption of those foods. The present ongoing destruction of the resource base leads to further cultural disruption for Karuk people today. As Ron Reed notes "Its not just about fish. Its about the traditions, the culture, the quality of life that we are lacking."

Other consequences from the lack of traditional foods to the social structure are equally significant. One outcome of diabetes is early death due to associated conditions (i.e. heart disease, kidney failure). Numerous people recounted a pattern of earlier deaths amongst elders in recent times as compared with remarkably long-lived elders in years past.

> My mom has high blood pressure. I have elevated blood pressure. My dad has high blood pressure. But in contrast, my uncle Lefty's 90. He was born in 1911, I think, and he is still alive. My auntie Mollier is born in 1912. So they have lived a long time, a good healthy people. I think the lack of salmon in my diet has had huge effects especially on my heart pressure, blood pressure and stress and all that kind of stuff.
>
> Scott Quinn, Karuk Tribal Member

When elders die young they are not available to pass information and love on to the younger generations. Ron Reed describes the disruption to the social order that comes from losing elders in a family:

> We are a people who are not allowed to have fish anymore because there's not enough fish to have. It has been three generations for my people not to be living mainly on fish. And to have the different type of environment now for the children, for the elderly people. It has a profound affect on the quality of life. By tradition our elders teach our babies the ways of life while the parents are out making a living. Now we don't have that opportunity because of the mismanagement of the resources. Our people aren't living to a ripe old age and when they do they aren't living the high quality of life. So we need fish in our diet. That is very evident.

Similarly, Trafzer and Weiner (2001) note that the strength of Native peoples in some regions may be in jeopardy because the loss of numerous community healers and shamans due to early death throughout the past century has decreased the ability to protect people.

Loss of Traditional Foods: Mental Health Consequences

> "I like to think I'm not that old, and it hasn't been that many years ago, but out of the 15 or so kids in my sixth grade class photo, I've buried ten of them. And most of them are buried 10 – 20 years ago. Most of them never made it out of high school. That's 10 out of 15. And a couple of them, since that time, more recent. There's reasons why none of those people in that picture made it out of high school. There's reasons why none of those people in that picture ever made it to college. There's reasons why most of those people aren't alive anymore. And you can attribute those things to physical things. You can attribute them to physical violence or accidents or whatever. But it's not an accident. It's not an accident."
>
> Leaf Hillman, Karuk Ceremonial Leader and Tribal Vice Chairman

Broader cultural impacts to the lack of traditional diet (or adequate diet of any type) lead to other social and cultural problems in communities. Numerous studies document how diet changes for Indian people may lead to a loss of culture and identity as the entire socioeconomic system is disrupted (Usher et al. 1995, Chan and Receveur 2000). I will describe here three sources of mental stress on Karuk people directly connected to the loss of the fishery: grief from the destruction of the species, the invisibility of this grief within the dominant culture, and trauma and loss of identity arising from the inability of individuals to perform their traditional social responsibilities.

There is evidence from both personal testimony and observation and preliminary data that Karuk people face significant mental health challenges resulting from the massive ongoing social disruption resulting from the loss of the fishery.

> I look around at our tribal people right here on the river and its like… beautiful people, beautiful heart. Angry people. And have a lot of problems. And those problems are manifested in different ways. But, people who get to know them on a personal basis can see that. Some people are very beautiful people, outside and inside. But there is something very ugly in them and it comes out at times. Different things trigger it and then they are not very nice people. They can be very mean people, and not fun to be around. And all of us get that way and different things trigger it and it gets back to that right there. It gets back to self-esteem. It gets back to that if you don't feel good, don't feel good in your head, don't feel good in your body…

Leaf Hillman, Karuk Ceremonial Leader and Tribal Vice Chairman

Mental health is more difficult to quantify than physical health, and because of its normative element, cross cultural assessments of mental health are subject to mis-interpretation and have been themselves the vehicle for mistreatment and racial misunderstanding. For example, Indian people are more likely than Euroamericans to be institutionalized in the mental health system. Addictive behaviors are best understood as the normal result of having experienced extreme forms of cultural genocide. Yet tribal members are often blamed for exhibiting addictive behaviors by both medical practitioners and the general non-Indian community. Suicide in Native Americans is identifiable not only by the high rate but by the pattern of youth suicide (rates are highest for those under 35) rather than amongst older age groups as with non-Indians in the US. Leaf Hillman comments on the connection between youth suicide, racism within the dominant culture and the loss of culture and identity:

> The one that's not so easy to quantify is why does a 13 year old boy shoot himself in the head. For what? Why? Well if I had to live in the damn Yreka ghetto, well I guess, that seemed like the best option. That guy never knew the river and the ceremonies. So, really how does that relate? It relates because that boy knew he Karuk and he hears about these things and he knows about these things, but he doesn't understand them. He knows that he's Indian because he lives in the Tribal housing project and he's surrounded by Indians. But whenever he steps out of that project and goes down town, it's all he knows, but never-the-less he doesn't fit there, doesn't belong there, and he may not know or understand why, but he knows that he doesn't belong there. And he knows that people don't want him there. He knows there must be something wrong with him, because he knows he's Karuk, he may be proud of that, but on the other hand, he knows there is something wrong with that. That's the most difficult thing to quantify, in terms of effect.
>
> Leaf Hillman, Karuk Ceremonial Leader and Tribal Vice Chairman

In Happy Camp High school a reported 20% of students were on court ordered drug and alcohol probation in the year 2000. Thirty percent of students reported that they felt sad or hopeless every day for two straight weeks. Siskiyou county ranks 50 of 58 counties in California for adolescent suicide and 42nd for juvenile arrests for alcohol and drug use. Although there are differences from tribe to tribe, the overall suicide rate for Native Americans is 1.5 times the national average. In contrast, researchers note that "renewing interest in traditional Indian identity, values and customs should help Native American adolescents achieve a positive balance between the strength of their people and opportunities available

in the larger society (Beauvais 2000, 110). Hillman describes the impacts of contact with ceremonies and Karuk traditions on his own outlook as a young person:

> As I grew up I went to the ceremonies that existed and I was trained as a world renewal priest at Katamin when I was 14 and served until I was 19 at that place. And that was such an influencing factor in my life, just changed my perspective on the entire world, the way I approached life. Prior to that, I was just like all of my friends and relations here in town: very angry, very angry young men with no prospects for the future.
>
> Leaf Hillman, Karuk Ceremonial Leader and Tribal Vice Chairman

Bringing back the ceremonies thus appears critically important for the mental well being of Karuk youth. Many of those who are taking leadership within the Karuk Tribe today are connected to the traditional religion. Both Ron Reed and Leaf Hillman specifically attribute their ability to "be where they are now" and take leadership in the face of such uncertainty to their religious practice:

> When I was younger I was never really into bettering myself educationally. It was always about one thing: getting out because of basketball. So anyway, I go out and I'm stumbling along, stumbling along. The reason why I made it, and the reason why I'm here today is because I'm part of a medicine family. When I stumbled back into the Karuk way, I stumbled right back in the right time. I was able to make medicine when I came back. That gave me the energy to move back in the ancestral territory up to Katamin, to do the things that a medicine man's supposed to do in these modern days. I'm very fortunate to be where I'm at, and I know a lot of my friends aren't or not where I am at. I know a lot of cousins are not where I'm at. So I don't know how to articulate why or how. I can just give you my personal experience of what I went through, and then when I did come back, it was luck. We call it medicine. It's medicine. Until you do the things that you were put here on earth to do, you'll always have to live in turmoil.
>
> Ron Reed, Traditional Karuk Fisherman

> The resurgence, bringing back our ceremonies is very important. Very important because I know that at a certain point in my life I've been trained as a priest, participation in ceremonies, I know that it probably saved my life. Just prior to that time, some of my very best friends in the world, right here in Orleans, they never grew up: they died. Standing next to my best friend gunned down in downtown Orleans. Shot in the back 18 times with an Uzi sub-machine gun. Why? Because wrong place, wrong time. And wrong colored skin. And then my other partner there died when he was 13 years old. He overdosed. So, I'm convinced that they saved me and made me a better person. And it helped me to survive because, it took a while, it didn't immediately happen, it change me to where I'd talk about things instead of trying go fight somebody or shoot somebody. That there were more important things. And that there was a reason to live. There was a reason why I'm here. The reason's not all those things I though before.
>
> Leaf Hillman, Karuk Ceremonial Leader and Tribal Vice Chairman

Kuhnlein and Chan describe "multiple socio-cultural values that contribute to mental health and cultural morale" (2000, 615). For example, difficulty in meeting basic needs results in overwhelming physical and psychological stress. Brooke Olson recounts how "some Native peoples living a Western lifestyle (e.g. the Dogrib) may experience more stress and more difficulty in adjusting to different life ways, thus making the body less capable of regulating blood sugar levels, a condition that if prolonged can lead to diabetes" (2001, 166).

Another fundamental, but often invisible, factor influencing the health and well-being of Karuk people is the decreasing relevance of tribal customs and laws relating to resource management and harvest practices. Leaf Hillman notes that "when non-native people and government agencies ignore and disregard Karuk customs (laws and practices) these customs become irrelevant within our own culture." Hillman provides multiple examples:

> Karuk customs (laws and practices) concerning the management and harvesting of Tan Oak Mushrooms e.g. family/village responsibility for management and harvesting rights in certain defined geographic areas, remained largely intact until very recently. This can be explained by the lack of interest on the part of non-natives and government agencies alike. Because no one else cared and these customs did not interfere with anyone else, they remained relevant within Karuk culture. However, all of this disappeared virtually overnight when it was learned that tan Oak Mushrooms were in fact, Matsutakes and that a lucrative market existed for this species in japan and other Asian markets. Large numbers of outsiders and locals flooded the forests within Karuk territory, and big money was to be had at the local buying stations that sprung up overnight in our communities. In our local river communities where unemployment rates are extremely high and employment opportunities are almost non-existent, local people including Karuk quickly realized that they could make more money in a few days picking and selling mushrooms, than they ordinarily would expect to earn in an entire year or even two. In this environment, following Karuk customs simply meant that they could not compete with the hoards of outsiders flooding the area, and even if they did not violate Karuk customs (laws and practices), there would be hundred of others that certainly would. Therefore, the customs themselves along with their underlying purpose and intention, no longer had relevance in Karuk culture.

Loss of relationships with the natural world, as when entire salmon runs disappear, leads to profound grief. Karuk Tribal members describe feelings of sadness and depression from experiencing loss of salmon, of watching the struggle and suffering of family and community around them, and of being unable to fulfill their social roles of providing for others.

> I think it's remarkably sad that in my teenage years I ate a tremendous amount of salmon or deer meat, and now its hardly ever eaten. My husband and I both hunt so we can expose our children to big game, but there is just a TERRIBLE shortage in salmon now that when my little Indian daughters eat it they think it's a treat. Every time I hear of someone getting salmon I try to get some… either from other fishers, fishsers from DNR or Yuroks. This way I can freeze it and have it for my family or family gatherings… In the past 2 years I was only able to get 1 salmon… When I was growing up… men would pull up and unload tons of salmon (fresh) and after all the Indian families received enough for their families or ceremonies the remaining was given to families in need. (white families) Now, Indians have to go to Indians to see if they may have salmon for their ceremonies or traditions. I don't know what has happened in the last ten to fifteen years for there to be this drastic change, but it saddens me to have my children not enjoy the same simple happy memories of eating salmon with all the old Indians and hearing stories of catching them, dipping them, and packing them out.
>
> Anonymous, comment written in on survey, May 2005

> I don't know what I'm missing. I think that's what the issue is here, that a lot of my people, because of disconnection, by being disenfranchised, we don't know what we're missing. We don't know.
>
> Ron Reed, Traditional Karuk Fisherman

I asked Blanche Moore, if there was a healthier run of salmon on the river, how do you think it would affect how people live?

> Oh it would be wonderful. I know that if, a lot of them that still believes in cannin' salmon for the, to help them out through the winter months and stuff like that. I know that they would do it. Either that or freeze it or put it in the smoke house. But it would be great.
>
> Blanche Moore, Karuk Tribal Member

At stake with the loss of the fisheries is not only cultural survival, but the physical survival of each tribal member. Data from tribal medical records indicate that seventy percent of tribal members over 60 have diabetes (four times the national average for this age group). As described in Chapter Three, diabetes is the fifth-deadliest disease in the United States. And the literal death of individuals is part of the larger cultural loss. Early deaths are not only a social burden for the tribe in terms of the sadness and grief, they decrease the tribes' ability to carry out other cultural activities.

> Last year, we was going to have the Brush Dance here in Happy Camp for the first time in a lot of years. And there was just too many deaths you know in our Tribe. So we

just couldn't do it.

Blanche Moore, Karuk Tribal Member

I know I've had several of my relatives have passed away here. They wasn't very old. And it was diabetes. And so, that's what really scares me. Diabetes. And then another family member just told me here not too long ago that he has high blood pressure. Now that's another one here too that's pretty bad. And he's only like in his thirties. He's thirty-seven.

Blanche Moore, Karuk Tribal Member

As each generation of elders pass on knowledge of culture and history disappears.

You want to talk about food. I don't know as much about food as I probably should. The most of what I should have known was lost when my great-grandmother died. I have tried to find out a lot of things about it.

David Arwood, Traditional Karuk Fisherman, Age 54

Karuk families have experienced direct genocide within the memory of people alive today. Such trauma is furthermore is an ongoing process through the destruction of the resource base and the loss of culture today. Yet both the recent genocide and the present ongoing forms of racism are unrecognized within the dominant society. In their article on unresolved grief from the Indian Holocaust, Brave Heart and DeBruyn describe how the invisibility of this grief within the dominant culture is an additional source of stress.

> "American Indians and Alaska Natives are plagued by high rates of suicide, homicide, accidental deaths, domestic violence, child abuse and alcoholism as well as other social problems. Racism and oppression, including internalized oppression are continuos forces which exacerbate these destructive behaviors. We suggest that these social ills are primarily the product of a legacy of chronic trauma and unresolved grief across generations. It is proposed that this phenomenon, which we label historical unresolved grief, contributes to the current social pathology, originating from the loss of lives, land and vital aspects of Native culture and promulgated by the European conquest of the Americas" (1998, 60).

Not only does the dominant culture fail to acknowledge the direct genocide of Indian people, a vast gap in world views further perpetuates the invisibility of Native grief. Brave Heart and DeBruyn note that "For Europeans ownership of land is a dominant value. For American Indians, land, plants, and animal are considered sacred relatives, far beyond a concept of property. Their loss becomes a source of grief" 1998, 62). Karuk cultural practices include acts of tending places, plants and animals. The

inability to perform these practices and maintain these relationships of burning tan oaks for food or tending mussel beds is the inability to carry out culture. It is for these reasons that the present decreasing access to traditional foods must be understood in the broader context of cultural genocide. The stress of this and other aspects of forced assimilation can in turn create or exacerbate physical (as well as emotional) health challenges.

In addition to broader social impacts for the tribe, there are more individualized challenges concerning the loss of traditional social roles. Karuk people have traditional roles within their families and community, with these roles come responsibilities to provide fish, deer or acorns, or to put on ceremonies. Yet when there are no fish, no acorns available people cannot fulfill these responsibilities.

> I know that there's a lot of families here that is their main food is salmon. We have a lot of families come down from Fort Jones area, Etna, there's a lot of tribal members that live out there, came down to the Falls, last year, hoping to get salmon. And it was so sad because there just wasn't any. And well, we got one salmon that my son brought home. So I told him, whatever you get now we'll have to freeze for our Tribal Reunion. So we had eleven salmon and that didn't even, we had a lot of people this year, a lot of people. So, a lot of them got salmon and a lot of them didn't. But there was just nothing I could do about it. We did the best that we could.
>
> Blanche Moore, Karuk Tribal Member

> When you're not able to go upslope and go manage, you're not able to go up and reap the harvest of that management and when you're not able to go produce for your children and give things for each other for the well-being of life, then all of a sudden, that puts you in this little down feeling. You're down casting yourself. I think that's where a lot of the people in Karuk tribe are because of our inability to get to these resources that have been given to us by the creator. We understand very much that we're a proud people. We're here for a reason, but a lot of us struggle with modern society, trying to figure out how do we integrate into modern society?
>
> Ron Reed, Traditional Karuk Fisherman

In another example, Hillman describes the profound and multi-layered cultural impacts from denied access to the traditional management practices of managing oak stand for acorn production (done through the use of fire).

> A Karuk ceremonial leader/dance owner with explicit obligations to feed the people during ceremonies may (on a good year) be able to harvest and process enough acorns to meet this responsibility, but this means that he and his family cannot eat any acorns for the entire year or risk falling short during ceremonies. Therefore, in order to fulfill the mandate of the creator to feed the people at ceremonies, one must also violate them

> by denying the needs of your own family. Although many Karuk retain the specialized traditional knowledge necessary to manage oak stands for acorn production, this is strictly prohibited by the USDA Forest Service (even on a small scale).
>
> Leaf Hillman, Karuk Ceremonial Leader and Tribal Vice Chairman

In addition to emotional challenges to mental health, the rapid shift in diet may have added additional physical deficits to mental functioning . The worldwide prevalence of depression has been significantly correlated with low fish consumption (Hibbeln 1998). Recent research highlights the potential importance of omega 3-fatty acids to mental well being. These components would have been very high in the diets of Karuk people until recently. In a study to systematically test fish consumption with self reported mental health status, researchers Karen Silvers and Kate Scott found a positive association between high fish intake and higher scores on self reported mental health status (2002). Other studies find fish consumption inversely correlated with depression (Hibbeln 1998). Fish is the best source of omega three polyunsaturated fatty acids. Concentration of omega three fatty acids are significantly lower in the red blood cell membranes of depressed patients compared with controls (Peet, Murphy and Horrobin 1998, Edwards et al 1998).

Recent research conducted at Oxford University found that children's school performance improved dramatically when their diets were supplemented with omega-3 fatty acids from fish oils. The researchers found that 40% of the 117 children ages five to 12 made dramatic improvements in reading and spelling when given supplements high in omega-3 fatty acids. The children showed significant improvement in concentration and behavior. Symptoms of the sort associated with "attention deficiency and hyperactivity disorder (ADHD) were reduced by an order of magnitude – the degree of response that is usually observed with drugs such as Ritalin. Karuk dietician Jennifer Jackson notes the relationship between omega-3 fatty acid deficiency and behavioral disorders, such as attention deficit hyperactivity disorder:

> ". . . . these essential fatty acids have been specifically implicated in maintaining central nervous system function and they affect neurotransmitters, peptides, releasing factors, and hormones in the brain (Yehuda 1999). In a 1995 study, researchers found that 53 children with ADHD had significantly lower concentrations of omega-3 fatty acids in their plasma polar lipids and their red blood cell total lipids (Stevens 1995).

Jackson also reviews researcher into the role of fish oil in preventing age-related diseases, such as Alzheimers and other forms of dementia (Jackson 2005, 14). For example, Jackson notes recent studies

in which older individuals with low levels of omega-3 fatty acids in their blood appear to be more at risk for developing cognitive disorders, than those who regularly consume fish or fish oil supplements (Morris 2003).

CHAPTER SIX:

HEALTH CARE COSTS OF DIET RELATED DISEASES

"Diabetes imposes a substantial cost burden to society and, in particular, to those individuals with diabetes and their families."

Dr. Francine Kaufman, President American Diabetes Association

- **Diabetes has an average annual per capita cost of health care at $13,243 in the United States.**
- Given 148 diabetic Tribal Members and descendants within the ancestral territory, **the annual health care cost for Karuk Tribal members is estimated at 1.9 million dollars.**
- Per person indirect costs of diabetes in the form of lost workdays, permeant disability and premature death amount to an **additional $5,729 per year.**
- **Total direct and indirect costs** of diabetes for Karuk Tribal Members and descendants within the ancestral territory are **$2.75 million annually.**
- Additional diet related conditions in the Karuk Tribe including heart disease and high blood pressure are also costly.
- Increased medical care costs are **not reflected in PacifiCorp's dam operation expenditures,** nor are they withdrawn from the profits PacifiCorps receives from the production of electricity in a manner which damages the health of the Klamath riverine system. Instead the **higher health care costs of increased diabetes in the Karuk population are bourne by society as a whole**.
- PacifiCorps **does not reimburse** the Karuk Tribe, nor Siskiyou nor Humboldt Counties for the increased cost of health care that comes from the destruction of an abundant source of healthy food in the Klamath river.
- **Any cost-benefit analysis of the dams should include the 1.9 million annually to provide medical services and $847,897 annually in indirect costs for the artificially high incidence of diabetes in the Karuk Tribe.**

The diet related diseases that have recently appeared in the Karuk population at such alarming rates are costly. In addition to the previously discussed social and cultural costs that are beyond economic calculation, diabetes and other diet related diseases are expensive in dollar terms. Health care costs are collectively borne by taxpayers through finding for hospital services, county clinics, the Bureau of Indian Affairs and increased health insurance costs. Beyond that individuals pay for medical costs not covered by official channels including medicines, fees and transportation costs. Lost economic productivity due to illness, early retirement and early death is a burden both to individuals and families and to entire communities.

A recent report by the American Heart Association notes that hypertension, diabetes, heart disease, and strokes are amongst the most costly medical conditions in the country. The total annual economic cost of diabetes in 2002 was estimated to be $92 billion, or one out of every 10 health care dollars spent in the United States (ADA, 2003). This figure represents 19% of total personal health care expenditures in the U.S., despite the fact that diagnosed diabetes patients account for only 4.2% of the total U.S. population. Direct medical expenditures totaled $92 billion and comprised $23.2 billion for diabetes care, $24.6 billion for chronic diabetes-related complications, and $44.1 billion for excess prevalence of general medical conditions. People with diabetes face a significantly greater risk for both temporary incapacity, permanent disability and early death. In 2002 the indirect costs resulting from lost workdays, restricted activity days, mortality, and permanent disability due to diabetes totaled another $39.8 billion in the U.S. as a whole. According to this latest American Diabetes Association study, the nation spends $13,243 in health care costs on each person with diabetes, compared to $2,560 per person for people without diabetes.

Clearly diabetes imposes a substantial cost burden to society and to those individuals with diabetes and their families. Eliminating or reducing the health problems caused by diabetes could significantly improve the quality of life for those Karuk people with diabetes, while at the same time potentially reducing expenditures for health care services and increasing productivity in the regional economy. It is important to emphasize that these costly conditions are preventable. In the Klamath region, the prevalence of high quality naturally available foods was the preventative of these diseases for generations.

This chapter outlines recent economic research on the costs of diabetes and other diet related diseases in the United States as a whole, describes known costs of these diet related diseases as paid for by the Karuk Tribe, and calculates an estimate of the economic burden of artificially elevated rates of

diet related diseases based on methods used by the American Diabetes Association. The chapter closes with discussion of the concept of increase in these diet related diseases as an "externality," a hidden cost of economic activity that is placed onto society as a whole. In this case the cost of diabetes is incurred by the Karuk Tribe, local hospitals and other county and state resources and individuals and their families.

The figure of $13,243 per diabetic patient calculated by the latest American Diabetes Association study takes into account spending by individuals, employers, insurers and government programs such as Medicaid and Medicare for 2002. The direct medical costs of diabetes more than doubled in recent years, from $44 billion in 1997 to $91.8 billion in 2002. U.S. Health and Human Services Secretary Tommy G. Thompson emphasizes that these costs are a burden on families and the medical system: "Diabetes continues to be a huge financial burden on patients, their families and society, a burden that continues to grow in parallel with the obesity and diabetes epidemics in this country." Given that rates of diabetes are four times the national average, the burden to which Thompson refers is minimal compared with the burden faced by the Karuk Tribe and Siskiyou and Humboldt Counties. Estimated costs for medical services used to calculate this figure are provided in Table 13 below:

Table 13 Per Unit Price Estimates of Costs of Services to Diabetic Patients
Source: American Diabetes Association, 2002.

	Unit Price, 2002 Dollars
Hospital Day	$2,385
Nursing Home Day	$169
Office Based Physician Encounter	$160
Emergency Department Visit	$452
Ambulance Service	$247
Hospital Outpatient	$561
Outpatient medication	$47

Home Health Visit	$89
Hospice Care Day	$107

Applying the best available data on average national expenditures of $13,243 to the number of Karuk tribal members with diabetes in 2004 (148 individuals) yields an annual cost of over 1.9 million dollars, see Table 14 below:

Table 14: Estimated Direct Annual Per Capita Cost of Diabetes in Karuk Tribe

Cost Component	Average Annual Unit Cost (Source: American Diabetes Association, 2002)	Multiplied by 148 diabetic Karuk patients in 2004
Hospital inpatient	$6,309	$93,372
Nursing Home	$2,140	$316,720
Physician's Office	$1,525	$225,700
Hospital Outpatient	$489	$72.372
Emergency	$366	$54,168
Home Health	$516	$76,368
Hospice	$84	$12,432
Ambulance Service	$23	$3,404
Outpatient Medication	$797	$117,956
Insulin and delivery supplies	$579	$85,692
Oral agents	$414	$61,272
Average Per Patient Total Health Care Costs	**$13,243**	**$1,959,964**

This figures reflect extrapolation from data on average national expenditures. Health care costs differ by region and patient needs, e.g. not all patients use the same degree of services as factors such as age affect whether or not someone receives hospice care and so forth. Further research could be undertaken to adjust figures for the specifics of the Karuk population, e.g. age structure and actual

number of doctor, hospital and home visits and use of medications. Given that health care costs increase for older members of the population, and the fact that the gap between Karuk and national diabetes rates is greater amongst elders, such calculations would likely reveal the per person cost to be higher than the national estimate. Finally, these data are based on 2002 dollars and cost estimates and should be re-calculated for other years.

The costs of elevated diabetes in the Karuk population are paid by the Tribe, neighboring Tribes, regional hospitals and the national government (via reimbursement grants from Bureau of Indian Affairs). Costs of medications, transportation, hospitalization and clinic visits and lost employment potential that are not paid by above sources are incurred by individuals and their families. Calculation of which portion of this $1.9 million is actually paid by the Karuk Tribe, neighboring tribes, regional hospitals – or goes unpaid in the form of inadequate services – would entail significant further analysis.

On average Karuk diabetes patients paid 13.6 visits in a three year period or 4.5 doctor visits per person per year. This rate of doctor visits is in contrast to the national average of 9.5 doctor visits per patient per year used in the ADA study. Using national comparison cost data of $160 per visit from the ADA study, the average of 1,786 visits to Karuk clinics each year reflect a total cost of $285,760 for office based visits alone each year. This figure is half the average amount estimated per patient based on national averages. Costs to the Karuk Tribe for physician visits may be less than average national costs. However, fewer doctor visits may be a result of an underfunded system, reflecting inadequate resources for patient outreach, transportation of elder, home visits and other necessary services. Furthermore, in 2004 the tribe received reimbursement funding from Indian Health Services for a total of only $157,554, see Table 15 below. This figure includes not only doctor visits but all costs. Total average costs for outpatient medication and insulin and delivery supplies in the U.S. as indicated in Table 14 amount to $1,376 per person. National data thus indicate that cost to provide adequate medication to the 148 Karuk tribal members and descendants in the ancestral territory alone would be $203,648 per year. In contrast the Tribe was reimbursed for only $62,000 in medications in 2005.

Table 15: Reimbursement from "Contract Health Services" Diabetes Grant To Karuk Tribe

	Total Reimbursement	Medications
2004	$157,554	$42,000

2005	$163,000	$62,000

Furthermore, subtracting the $62,000 reimbursement for medications in 2005 leaves a minimum shortfall of $184,760 for estimated reimbursement for doctor's visits. Finally, the Karuk Tribe received these amounts in diabetes grant from Indian Heath Services to the Tribe for "Contract Health Services." These figures would be slightly under actual expenditures for diabetes because in order to get set up for the contract health services program diabetic patients need to go through a number of hoops that not everyone chooses to complete.

Part of the gap between national costs and funds paid by the Karuk Tribe may come from inequities in health funding for Native Americans in the United States. Furthermore, in a 2001 report for the Advisory Council on California Indian Policy, Carole Goldberg-Ambrose and Duane Champagne describe the relative under funding of health services for California Indians, even relative to other tribes:

> "Currently less than 1 percent of all federal general assistance funds is going to support California Indians, who comprise approximately 12 percent of all Indians nationwide . . . For the 1990-1994 years, California Indians were funded at a rate of 1/4th to 1/2 of all other Indians." The report also finds that "funding from the Indian Health Service for California Indians is about 30-40 percent less than the national average over 1988 through 1995. Housing and Urban Development Indian Housing programs also show a systematic under-funding over the last decade."
>
> Goldberg-Ambrose and Champagne 2001

Direct and Indirect Costs

Cost calculations of diet related diseases by the American Heart Association and American Diabetic Association are measured in terms of direct and indirect costs. Direct costs include expenses such as doctor visits, medications, hospitalizations, hospice care and emergency room visits. These are not the only costs of these conditions. There are also indirect costs resulting from lost workdays, days when individuals experience restricted activity, permanent disability, lost future earnings and mortality. The recent American Diabetes Association study reported the total indirect costs due to diabetes at $39.8 billion in 2002, or a total per person indirect cost of $5,729 per year. When multiplied by the number of Karuk and Karuk decedents with diabetes (148) this amounts to $847,892 annually. The present impoverishment of Karuk individuals discussed in Chapter Four must be understood in the context of

the indirect cost of diabetes on many individual's ability to maintain full employment and earnings over their lifetimes. When annual direct and indirect costs of diabetes are combined this amounts to a total of $18,972 per person and $2.75 million for all tribal members.

Indirect Social Burden

In addition to the direct financial burden and indirect financial burden from the increased incidence of these diseases, we can describe an indirect social burden. In the case of the Karuk, the indirect social burden includes the cumulative impact of indirect costs described above on an entire community, and the non-market cultural impacts discussed in Chapter Five, including lost relationships between youth and elders, loss of cultural ecological knowledge and cultural survival itself.

Costs of Other Diet Related Diseases

Diabetes is not the only expensive diet related disease experienced by Karuk Tribal members. Nor is it the only condition that is artificially elevated in the population. Heart disease, obesity, hypertension and other conditions discussed in Chapter Three are both diet related and reported to have increased overnight in the same time period following the loss of the salmon in the Klamath river and the Karuk diet.

> "The cost of cardiovascular diseases and stroke in the United States in 2005 is estimated at $393.5 billion. This figure includes health expenditures (direct costs, which include the cost of physicians and other professionals, hospital and nursing home services, the cost of medications, home health care and other medical durables) and lost productivity resulting from morbidity and mortality (indirect costs)." (P. 55)

The recent American Heart Association study reveals that cost of all forms of cardiovascular disease in 2005 total $393.5 billion in the US as a whole. This figure divided by the 70.1 million people who have some form of heart condition yields an average figure of $5,613 per person in direct and indirect costs. Estimates of national costs from both the American Diabetes Association and American Heart Association are provided in Table 16 below. Note that these costs are not mutually exclusive, i.e. the cost of diabetes potentially includes some costs associated with heart disease and other conditions such as increased doctor visits.

Table 16
Total and Average Per Person Costs of Diet Related Diseases in the United States, 2005

Source: American Diabetes Association 2002, American Heart Association, 2005

	Diabetes (2002 estimate)	High Blood Pressure	Strokes	Coronary Heart Disease
Total Direct Cost	92 billion	59.7 billion (divided by 65 million)	56.8 billion (divided by 5.4 million people in US)	142.1 billion (divided by13 million people)
Per Person Cost	$13,243	$918	$10,518	$10,930

Obesity is also an expensive condition. Recent analysis of medical records, doctor visits and other health care treatments related to obesity calculated the total cost of these conditions in the United States in 1995 at $51.6 billion (Raebel et al 2004). They compared those costs between obese and non-obese people. The obese group had more prescriptions filled than non-obese people (11 versus 6 on average), and used more prescription drugs for high blood pressure, allergies, asthma, ulcers, diabetes, thyroid problems, and pain. For people in the study, the higher their body mass index (BMI), the higher their health care costs (Raebel et al 2004).

The Journal of the American Medical Association reported in 2004 that obesity in younger adults leads to in increased medical costs for these individuals later in life (Daviglus et al 2004). The study followed over 1500 patients ranging in age from 33 to 64 years from 1984–2002. The annual cost medical care cost for normal to overweight men was $7,205 and total cost over the time period was $100,431. In contrast, the annual medical care cost for obese men was $10,128, while total medical costs over the time period was $119,318. The differences were even greater for women: for normal to overweight women the annual cost of health care was $6,224 and total cost was $76,866. The annual cost for obese women was $9,612 and total cost was $125,470.

Diet Related Diseases as an "Externality"

In economic terms, costs that do not appear in market decisions, but nonetheless produce social and economic outcomes are "externalities." A negative externality is the cost of an activity that is not paid by the producer, but is instead borne by society at large. For example, oil refineries may produce costs to neighboring residents in the form of air or groundwater pollution. The presence of negative externalities may lead to the over-production of goods that have a high social cost because individual producers have no incentive to factor in these externalities. More of these activities take place than if

their cost had a true accounting. The activity is economically viable for the producer only because the true costs are shouldered by society.

When people are denied access to the healthy foods upon which they have subsisted for millennia, it costs money. Individuals will now need to purchase healthy foods elsewhere (see Chapter Four). If they are unable to obtain foods of similar quality as once available in the local ecosystem, as is clearly the case for the Karuk, individuals face the likelihood of developing diet related diseases such as diabetes, obesity, heart conditions and high blood pressure. The fact that Karuk tribal members are denied access to the healthy foods that supported them since time immemorial also costs society. When a significant number of people, such as an entire Tribe, face epidemic rates of expensive conditions such as diabetes, sizable federal, state, county and tribal medical resources will be taxed to respond to the crisis. However these increased medical care costs, paid by society as a whole, are not reflected in PacifiCorp's dam operation expenditures, nor are they withdrawn from the profits PacifiCorps receives from the production of electricity in a manner which damages the health of the Klamath riverine system. Instead the higher health care costs of artificially increased diabetes in the Karuk population are borne by society as a whole. PacifiCorps does not reimburse the Karuk Tribe, the Bureau of Indian Affairs, nor Siskiyou or Humboldt Counties for the increased cost of health care that comes from the destruction of an abundant source of healthy food in the Klamath river. Any cost-benefit analysis of the dams should include the $1.9 million dollars that are required annually to provide medical services and the $847,897 incurred annually in indirect costs for the artificially high incidence of diabetes in the Karuk Tribe. Further analysis of the costs of other diet related diseases, as well as the replacement costs from the loss of subsistence food, should be undertaken immediately. Until this is completed, the full impact of dam operation cannot be assessed.

APPENDIX A: METHODS

This research was conducted on site in the Karuk ancestral territory along the Klamath River over a nine month period in the Spring and Summer of 2005. Study design used triangulation of multiple methods. Health data were complied from Karuk tribal medical records and from the Karuk Health and Fish Consumption Survey. Economic analyses were based upon data from the U.S. Census, the Bureau of Indian Affairs and the Karuk Tribal Census. Interpretive data on cultural and spiritual impacts of declining salmon was assessed through both in depth qualitative techniques (through the use of in-depth interviews) and representative data (from the survey). Detailed information on each area is provided below.

Medical Data

Medical data were obtained from Public Health Nurse David Eisenberg in the Happy Camp Tribal Office on May 21, 2005. Numbers of tribal members and descendants who had been to a clinic at least once within a three year period for diabetes were pulled from the RPMS database. This number was pulled for the period from January 1, 2000 to May 21, 2005 to adjust for year to year variation. Data on heart conditions, high blood pressure, overweight and obesity were also provided. High blood pressure was defined as persons who had recorded at least three diastolic measurements over 90. Limitations of official medical records include inaccuracies in RPMS data system and the fact that historical data in particular are not considered valid. Furthermore, not all persons with conditions are in the medical system. An unknown number of tribal members are undiagnosed, use private insurance, or do not use medical system. Statewide tribal diabetes analysts at the California Rural Indian Health Board indicated the Karuk as one of about five Tribes in California who were believed to have under-reported diabetes rates (personal conversation, July 2004).

To augment medical data and for comparison with fish consumption data, self-reported prevalence of health conditions including diabetes, heart disease, high blood pressure and overweight/obesity were gathered in the Karuk Health and Fish Consumption Survey in the Spring of 2005. See below for more details on this process. Family history information on these conditions were included, as well as information on age of death of family members. Medical and self report data generally correspond, suggesting accuracy in findings.

Economic Data

Data on income, employment, unemployment and poverty rates are from the U.S. Census, the Bureau of Indian Affairs and the Karuk Tribal Census, as specified where reported in tables throughout Chapter Four.

In-depth Interviews

The first phase of the qualitative portion of the project consisted of preliminary discussions with members of the Karuk Department of Natural resources and the use of archival research to outline existing information, data gaps and key issues for further research. Particular attention was paid to data gaps regarding the economic, cultural and health impacts of fisheries decline.

Second, in depth interviews were used to gather detailed information from tribal members regarding the above issues of concern. Socio-economic questions focused on perceptions of employment, the local economy, food gathering, and emigration. Information was also gathered on family history and health conditions over time. Although questions were developed in advance, interviews were open ended and semi-structured to allow for the emergence of new information. In depth interviews were conducted with a total of 18 individuals. These individuals served as "key informants" regarding a range of cultural and fisheries topics. Interviewees were selected to reflect a range of tribal knowledge, age backgrounds and from multiple families and geographic ranges in order to reflect a variety of viewpoints and key information. Most interviews were conducted individually. Where appropriate several interviews were conducted in pairs.

The study focuses on the experience of tribal members within the ancestral territory. Yet tribal members who have moved out of the area recently are also knowledgeable concerning past river conditions. Furthermore, many tribal members living outside the territory return to the area for ceremonies, to get fish and visit families. They are therefore impacted by river conditions. In order to evaluate potential differences between those tribal members within and outside the ancestral territory, and to reflect the most complete knowledge of impacts, we conducted one focus group of individuals living in Yreka, CA (outside the ancestral territory). All interviews were tape recorded and transcribed verbatim.

The 2005 Karuk Heath and Fish Consumption Survey

While interviews allowed for in depth description of impacts, there is always the possibility that the

information received in this forum is not representative of the experiences of tribal members on the whole. The survey contained 61 questions designed to evaluate the range of economic, health and cultural impacts for Tribal members of the decline in quality of the Klamath River system. The survey questionnaire contained both questions drawn from previously conducted surveys by other tribes (e.g. Columbia River Intertribal Fish and Water Commission) and questions constructed specifically in the Karuk context as a result of information gathered during in-depth interviews. The Karuk Health and Fish Consumption Survey allowed for the collection of quantitative data regarding economic patterns, health conditions and fish consumption that has been long absent in the broader discussion of tribal impacts of riverine health.

Sampling Frame, Survey Distribution and Response Rate

Sampling frame for the survey consisted of a list of names, generated by the Karuk Tribe's Enrollment Office, of enrolled Karuk Tribal members eighteen years of age or older and living on the ancestral territory. The survey was confidential. Confidentiality was maintained by coding each survey with a number. In order to maximize response rate the survey was distributed face to face to tribal members by other tribal members. Tribal members were told that the information compiled would be used in the FERC process and encouraged to participate. Community Health workers delivered the majority of the surveys over a three week period on personal visits to people's homes though some surveys were delivered through personal networks. A week before the survey was distributed, we sent out a letter of intent informing people that the survey would be delivered to their homes and requesting their participation. Individuals delivering surveys offered assistance to those who needed help filling in the survey because of physical impairment or illiteracy. Most surveys were collected on follow-up visits to people's homes. There were also confidential drop-boxes located at both the Happy Camp and Orleans Tribal Offices. There was a lottery incentive with cash and food prizes.

The original list provided by the Karuk Tribal Enrollment Office contained 298 names. Of these there was one duplicate and 32 known bad addresses (people who had moved, were currently out of the area or were in jail). Removing these names from the original list gave us a target population size of 266. Of these, 90 surveys were returned, and 10 were refused and 33 went undelivered after multiple attempts.

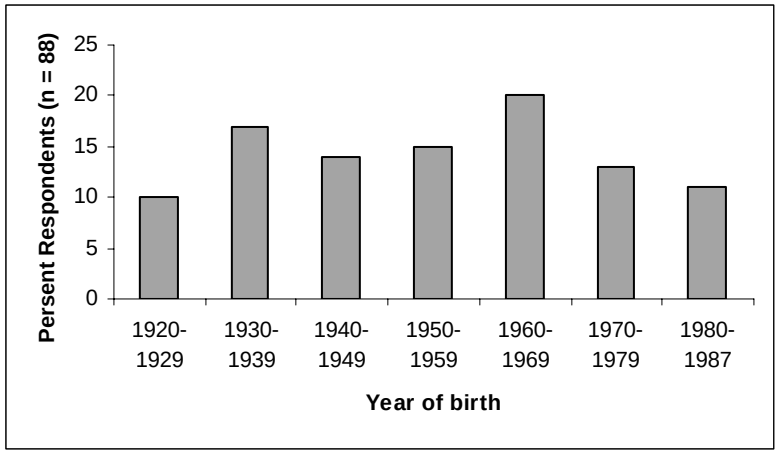
While the distribution of the survey by community health workers made it possible to get responses from many people who would not otherwise have been willing to participate, the downside

was that record keeping was difficult for Health Workers as they voluntarily took on the responsibility of distributing the survey on top of their already heavy workloads and often distributed the surveys at medical appointments. As a result, there were 133 surveys that could not be accounted for. We believe that the majority of these surveys were not delivered due to time constraints (those delivering the survey were not able to connect with all listed individuals) and incorrect addresses. Assuredly some surveys were also refused. Calculating a response rate using only those surveys whose outcome is known, 90 of the original 266 surveys yields a minimum response rate of 34%. Given that we know many surveys were not delivered, the response rate is certainly much higher, but exactly how much is impossible to determine.

Sex and Age Distribution of Respondents

The sex and age distribution of respondents was balanced with 51% male and 49% female respondents. Respondents were well distributed across age groups as indicated in Table 17 below:

Table 17 Age Distribution of Survey Respondents



Bibliography

Alaimo K, Olson CM, Frongillo EA Jr, Briefel RA. 2001 "Food insufficiency, family income and health in US preschool and school-aged children." Am J Public Health 91: 781-786.

Albert, Christine et al, 2002. "Blood Levels of Long-Chain n-3 Fatty Acids and the Risk of Sudden Death" New England Journal of Medicine 346: 1113-1118.

Albert CM, Hennekens CH, O'Donnell CJ, et al. 1998. "Fish consumption and risk of sudden cardiac death." Journal of the American Medical Association. 279(1):23-28.

American Diabetes Association. 2003. "Economic Costs of Diabetes in the U.S. in 2002" Diabetes Care 26 (3): 917-932.

American Heart Association 2003 "Heart Disease and Stroke Statistics American Heart Association 2003 Update" available online at www.americanheart.org

Ando, C., R. Segawa, C. Gana, L. Li, J. Walters, R. Sava, T. Barry, K.S. Goh, P. Lee, D. Tran, J. White, J. Hsu. 2003. "Dissipation and Offsite Movement of Forestry Herbicides in Plants of Importance to Native Americans in California National Forests." Bull. Environ. Contam. Toxicol. 71:354-361.

Appavoo DM,S. Kubow and H Kuhlein 1991. "Lipid composition of indigenous foods eaten by the Sahtu (Hareskin) Dene-Metis of the Northwest Territories." Journal of Food Composition Anals 4: 108-120.

Beauvais, Fred "Indian Adolescence: Opportunity and Challenge" pp 110-140 in Montemaayore, Ramond, Adams R and Gullotta Thomas (eds) Adolescent Diversity in Ethnic Economic and Cultural Contexts Thousand Oaks: Sage, 2000.

Bell, Maureen Karuk: The Upriver People Happy Camp, CA: Naturgraph Publishers, 1991.

Birch, Eileen et al, 1998. "Visual Acuity and the Essentiality of Docasahexanoic Acid and Arachidonic Acid in the Diet of Term Infants" Pediatric Research 4 4(2):201-209.

Boyce, VL and BA Swinburn. 1993. "The traditional Pima Indian Diet. Composition and adaptation for use in a dietary intervention study" Diabetes Care 16(1): 369-371.

Brave Heart, M. & DeBruyn, L. 1998. "The America Indian Holocaust: Healing historical unresolved grief." American Indian and Alaskan Native Mental Health Research, 8, 60-82.

Bruinsma K, Taren D. Dieting 2000. "Essential fatty acids intake, and depression. Nutrition Reviews, 58:98-108.

Bullard, Robert D. (ed) Confronting environmental racism: voices from the grassroots Boston Mass: South End Press, 1993.

Burrows et al 2000. "Prevalence of Diabetes among Native Americans and Alaska Natives 1990-1997" Diabetes Care 23(12): 1786-1790.

California Department of Fish and Game Salmon River Waterway Management Plan Sacramento, CA, 1979.

California Department of Water Resources. Shasta/Klamath rivers water quality study. Northern District. Red Bluff, CA., 1986.

California Rural Indian Health Board (CRIHB) 2004. "Fact Sheet. The Appalling Health Status of American Indians" Available online at: http://www.crihb.org/campaign.htm

Campbell G. R. 1989. "The changing dimension of Native American health: A critical understanding of contemporary Native American health issues." American Indian Culture and Research Journal 12(4 &4): 1-20.

Cantrell, Betty G. 2001. "Access and Barriers to Food Items and Food Preparation among the Plains Indians' wicazo sa review: A Journal of Native American Studies 16(1): 65-74

Caro, Ward and O'Brien 2002. "Lifetime Costs of Complications Resulting from Type 2 Diabetes in the U.S." Diabetes Care 25(2) 476-481.

CDC, 2003. Diabetes Prevalence Among American Indians and Alaska Natives and the Overall Population – United States 1994–2002 2003/52 (30); 702-704

Chan, Hing Man and Olivier Receveur. 2000. "Mercury in the Traditional Diet of Indigenous Peoples in Canada" Environmental Pollution 110: 1-2.

Davis, Barbara and Michael Hendryx. Plants and the People: The Ethnobotany of the Karuk Tribe. Yreka, CA: Siskiyou County Museum, 1991.

Department of Pesticide Regulation, Pesticide Use Reports 2002. Available online at: http://www.cdpr.ca.gov/docs/pur/purmain.htm

Doka, K. Disenfranchised Grief: Recognizing Hidden Sorrow Lexintton MA: D. C Health and Compny, 1989.

Echohawk, Marlene 1997. "Suicide: The scourge of Native American People." Suicide and Life Threatening Behavior 27(1): 6--67.

Elder, D. et al Salmon River Sub-basin Steps to Recovery and Conservation of Aquatic Resources. Prepared for The Klamath River Basin Fisheries Restoration Task Force, Yreka Fish and Wildlife Office, Yreka CA, 2002.

Friedberg CE, Janssen MJ, Heine RJ, Grobbee DE. 1998. "Fish oil and glycemic control in diabetes: a meta-analysis." Diabetes Care. 21:494-500.

Gohdes, D 1995. "Diabetes in North American Indians and Alaska Natives" in Diabetes in America Harris MI, Cowie CC, Sterm MP Boyko EJ Reiber GE Bennet PH eds. Washington DC US Department of Heath Services DHHS Publ no NIH 95-1468) p 683-695.

Harrison, Gail et al. "Over 2.2 Million Low Income Californian Adults are Food-Insecure, 658,000 Suffer Hunger" U.C. L.A. Center for Health Policy Research, 2002. Available online at: http://www.lafightshunger.org/images/hunger.pdf

Hewes, Gordon W. 1973. "Indian Fisheries Productivity in Pre-contact Times in the Pacific Salmon Area" Northwest Anthropological Research Notes 7(3): 133-155.

Hibbeln Joseph 1998. "Fish consumption and major depression." Lancet 351:1213.

Howard, BV, WG Aabbott and BA Swinburn. 1991. "Evaluation of metabolic effects of substitution of complex carbohydrates for saturated fat in individuals with obesity and NIDDM" Diabetes Care 14(9): 786-95.

Hu, FB, L Bronner, WC Willett, et al. 2002. Fish and omega-3 fatty acid intake and risk of coronary heart disease in women. Journal of the American Medical Association; 287(14):1815-21.

Iso H, Rexrode KM, Stampfer MJ, Manson JE, Colditz GA, Speizer FE 2001. "Intake of fish and omega-3 fatty acids and risk of stroke in women."Journal of the American Medical Association. 285(3):304-312.

Indigenous Environmental Network, 2001. Statement on the Right to Food and Food Security. Available on line at http://www.ienearth.org/food_security.html (accessed 8/10/04).

Jackson, Cecile 1993. in Joe and Young Diabetes as a Disease of Civilization: the impact of cultural change on indigenous people Berlin: Walter de Gruyter and Co., 1993

Jackson, Jennifer 2005 "Nutritional Analysis of Traditional and Present Foodsof the Karuk People and Development of Public Outreach Materials" Karuk Tribe of California, Happy Camp, CA

Jackson, M 1986. "Nutrition in American Indian health: Past, Present and Future" Journal of the American Dietic Association 86(11): 1561-1565.

Jacobs Starkey, Linda, Kaatherine Gray-Donald and Harriet Kuhnlein 1999. "Nutrient Intake of Food Bank Users is Related to Frequency of Food Bank Use, Household Size, Smoking, Education and Country of Birth" The Journal of Nutrition 883-889.

Joe, Jennie and Robert Young Diabetes as a Disease of Civilization: the impact of cultural change on indigenous people Berlin: Walter de Gruyter and Co., 1993.

Karuk Tribe of California (KTOC). Demographics Survey figures for Siskiyou County, Happy Camp, CA 2004.

Karuk Tribal Clinic 2004. July 30, 2004 'Top Ten Primary Visit Report," Visit Dates January 1, 2003, to December 31, 2003.

Kauffman, Jo Ann and Yvette Joseph-Fox " American Indian and Alaska Native Women" pp. 68-93 in Marcia Batbe-Smith (ed) Race, Gender and Health Thousand Oaks, CA, Sage, 1996 :

Kier Associates. Analysis of Sufficiency of the PacifiCorp Klamath Hydroelectric Project Final License Application With Regard to Project Water Quality Impacts. Performed under contract to the Klamath Basin Tribal Water Quality Work Group, 2004.

King, Thomas K. First Salmon The Klamath Cultural Riverscape and the Klamath Hydroelctric Project Klamath River Intertribal Fish and Water Comission, 2004. Available online at: http://elibrary.ferc.gov/idmws/File_list.asp?document_id=4205564

Kruger MC, Coetzer H, de Winter R, Gericke G, van Papendorp DH. 1998. "Calcium, gamma-linolenic acid and eicosapentaenoic acid supplementation in senile osteoporosis." Aging Clin Exp Res. 10:385-394.

Kuhnlein Harriet 1992. "Change in the use of traditional food by the Nuxalk native people of British Columbia" Ecological Food Nutrients 27: 259-282.

Kuhnlein Harriet and O. Receveur 1996. 'Dietary change and traditional food systems of Indigenous Peoples' Annual Review of Nutrition 16: 417-442.

Kuhnlein, Harriet V and H. M. Chan 2000. "Environment and Contaminants in Traditional Food Systems of Northern Indigenous Peoples" Annual Review of Nutrition 20: 595-626.

Kuhnlein Harriet, Kubow, S. and R. Soueida 1991. "Lipid components of traditional Inuit foods and diets of Baffin Island." Journal of Food Composition Anals 4: 227-236.

Kuhnlein Harriet , Appavoo DM, Morrison N Soueid R and P. Pierrot 1994. "Use and Nutrient Composition of Traditional Sahtu (Hareskin) Dene/Metis food" Journal of Food Composition Anals 7: 144-157.

Kruckenberg, Kami and Danika Choe. Touched By Hunger: A County By County Report on Hunger and Food Insecurity in California. Food Policy Advocates, CA., 2003.

Lowry, Chag (ed). Northwest Indigenous Gold Rush History: the Indian Survivors of California's Holocaust. Arcata, CA: Indian Teacher and Educational Personnel Program, 1999.
Margetts, B.M. and A. A. Jackson 1993. "Interactions between people's diet and their smoking habits: The dietary and nutritional survey of British adults" British Medical Journal 307: 1381-1384.

Margolin, Malcom. The Way Lived: California Indian Stories, Songs & Reminiscences. Berkeley: Heyday Books, 1993.

McEvoy, Arthur E. The Fisherman's Problem: Ecology and Law in the California Fisheries 1850-1980.

Cambridge University Press, 1986.

McMurry, MP, MT Cerqueira, SL Connor, and WE Connor 1991. "Changes in lipid and lipoprotein levels and body weight in Tarahumara Indians after consumption of an affluent diet" New England Journal of Medicine Volume 325:1704-1708.

Moerman, Daniel E. Native American Ethnobotany Timber Press, Portland OR, 1998.

Morris MC, et. al. 2003. "Consumption of fish and n-3 fatty acids and risk of incident Alzheimer disease" Archives of Neurology 60(7):940-946.

Morrison NE, Receveur O, Kuhnlein H Appavoo DM, Soueda R and P Pierrot 1995. "Contemporary Sahtu Dene/Metis Use of Traditional and Market Food" Ecological Food Nutrition 34: 197-210.

Mokdad, et al. 2001. "Diabetes Trends among American Indians and Alaska natives 1990-1998." Diabetes Care 24(8): 1508-1509.

Najman, J. M. 1993. "Health and Poverty: Past, present and prospects for the Future." Social Science Medicine 36: 157-166.

National Academy of Sciences Endangered and Threatened Fishes in the Klamath River Basin: Causes of Decline and Strategies for Recovery National Research Council, 2004.

Neel, J.V. (1963) "Diabetes Mellitus: A "thrifty" genotype rendered detrimental by "progress"?" American Journal of Human Genetics, 14: 353-362.

Nobmann Ed, Mamleeva F and Klachkova, E. 1994. "A comparison of the diets of Siberian Chukotka and Alaska Native adults and recommendations for improved nutrition, a survey of selected previous studies" Arctic Medical Research 53(3): 123-129.

Norton, Jack Genocide in Northwestern California: When Our Worlds Cried San Francisco: Indian Historian Press, 1979.

O'Dea K. 1984 "Marked improvement in carbohydrate and lipid metabolism in diabetic Australian aborigines after temporary reversion to traditional lifestyle" Diabetes 33: 596-603.

Olson, Brooke 2001. "Meeting the Challenges of American Indian Diabetes: anthropological perspectives on treatment and prevention" in Trfzer and Weiner (eds). Medicine Ways: Disease, Health and Survival among Native Americans Walnut Creek, CA: Alta Mira, 2001.

Payne, Gary 1988. "Pesticide Residues in Wildlife: Violating Legal Standards?" The Journal of Pesticide Reform 7(4): 18-19.

Percy, Chris , David S. Freedman, Tim J. Gilbert, Linda White, Carol Ballew, and Ali Mokdad. 1997. "Prevalence of Hypertension among Navajo Indians: Findings from the Navajo Health and Nutrition Survey" The Journal of Nutrition 127 (10): 2114S- 2119.

Receveur O, M Boulay and H Kuhnlein 1997. "Decreasing traditional food use affects diet quality for adult Dene/Metis in 16 Communities of the Canadian Northwest Territories" Journal of Nutrition. 127: 2179-2186.

Riches, G. 1989. Food Banks, hunger nad economic growth: Charity or collective social security in the 1990's? NIN Rapport 4:5.

Rodrigues et al, 2000 "High Rates of Infant Macrosomia: A Comparison of Canadian Native and Non-Native Populations" Journal of Nutrition 130: 806-812

Salter, John F. White Paper on Behalf of the Karuk Tribe of California: A Context Statement Concerning the Effect of Iron Gate Dam on Traditional Resource Uses and Cultural Patterns of the Karuk People Within the Klamath River Corridor, 2003 Available online at http://elibrary.ferc.gov/idmws/docket_sheet.asp

Stercho, Amy 2005 "The Importance of Place-based Fisheries to the Karuk Tribe of California: A socio-economic study" Master's Thesis Humboldt State University, Arcata, California.

Sun Lee, Jung and Edward Frongillo 2001 "Nutritional and Health Consequences are associated with Food Insecurity Among US Elderly Persons" The Journal of Nutrition 1503.

Trfzer and Weiner (eds). Medicine Ways: Disease, Health and Survival Among Native Americans Walnut Creek, CA: Alta Mira, 2001.

Usher, P M Baikie, M Demmer, D. Nakashima, M Stevenson and M Stiles 1995. "Communicating About Contaminants in Country Food: The Experience of Aboriginal Communities." Res. Dep., Inuit Tapirisat of Canada, Ottawa, Canada.

U.S. Bureau of the Census, Census 2000 available online at: http://www.census.gov/

U.S. Dept Agriculture 1999. Household Food Security in the United States available online at: http://www.ers.usda.gov/Briefing/FoodSecurity/readings.htm

White et al 1997. "Rationale, Design dan Methodology for the Navajo Health and Nutrition Survey" 1997 Supplement to the Journal of Nutrition American Society for Nutritional Sciences.

Will, Julie C., Karen F. Strauss, James M. Mendlein, Carol Ballew, Linda L. White, and Douglas G. Peter 1997. "Diabetes Mellitus among Navajo Indians: Findings from the Navajo Health and Nutrition Survey" The Journal of Nutrition 127 (10): 2106S- 2113S.

Williams, et al 2001. "The Effect of Indian or Anglo Dietary Preference ion the Incidence of Diabetes in Pima Indians" Diabetes Care 24(5):811-816.

Young, T Kue 1997. "Recent Health Trends in the Native American Population" Population Research and Policy Review 16: 147-167.