Alaska Department of Fish and Game
Division of Wildlife Conservation

Federal Aid in Wildlife Restoration
Research Progress Report
Survey-Inventory Activities
1 July 1996 - 30 June 1997

Population and Habitat Ecology of Brown Bears on Admiralty and Chichagof Islands

Kimberly Titus
LaVern R Beier

argaret Edens

Grant W-24-5
Study 4.22
June 1998

STATE OF ALASKA
Tony Knowles, Governor

DEPARTMENT OF FISH AND GAME
Frank Rue, Commissioner

DIVISION OF WILDLIFE CONSERVATION
Wayne L. Regelin, Director

Free copies of this report and other Division of Wildlife Conservation publications are available to the public. Please direct requests to our publications specialist:

Mary Hicks
Publications Specialist
ADF&G, Wildlife Conservation
P.O. Box 25526
Juneau, AK 99802
(907) 465-4190

RESEARCH PROGRESS REPORT

STATE: Alaska **STUDY:** 4.22

GRANT: W-24-5

TITLE: Population and Habitat Ecology of Brown Bears on Admiralty and Chichagof Islands

COOPERATORS: USDA Forest Service Regional Office - Juneau; USDA Forest Service Chatham Area Supervisor's Office - Sitka; USDA Forest Service Hoonah Ranger District.

AUTHORS: Kimberly Titus and LaVern R. Beier

PERIOD: 1 July 1996–30 June 1997

SUMMARY

Brown bears (*Ursus arctos*) are in high densities on Admiralty, Baranof, and Chichagof islands of Southeast Alaska, and they are also in varying densities on mainland areas. We studied brown bear use of riparian habitats where spawning salmon (*Oncorhyncus spp.*) provide an important seasonal food for brown bears leading to bear concentrations in nearby forests. Our 1100 km^2 Chichagof Island study area was within the Tongass National Forest, and it contained >25 salmon spawning streams. The Tongass National Forest has a history of forest management issues; revising the Tongass Land Management Plan has taken >10 years. We found that 62.9% of 2069 aerial radiotelemetry relocations from 111 radiocollared brown bears were in riparian habitats during the month of August. A panel of brown bear experts was convened as part of the science assessment during the revision of the Tongass plan. These scientists evaluated a portion of our radiotelemetry data in their risk assessment, and they recommended stream buffers of at least 500 feet where brown bears eat spawning salmon. We determined the proportion of relocations that were within 2 types of administrative buffers in the new Tongass forest plan. Twenty-four percent of August brown bear relocations were within the riparian standard and guideline buffer. This buffer was primarily designed to protect salmon habitat and maintain water quality. We also determined that 39% of the August brown bear relocations were within a 500-ft no-cut buffer if it was applied to all streams that had spawning salmon on the study area. The lower level of protection of bear relocations afforded by the riparian standard and guideline buffers was because they are usually <500 ft wide. The use of expert panels and scientific research findings in the revision of the Tongass forest plan was instrumental in assisting decision-makers with the information they needed to change historic land allocations and provide more habitat conservation for species such as the brown bear. The panel of brown bear experts recommended that a 500-ft no-cut forest buffer be placed on all salmon spawning streams used by brown

bears. The final forest plan weakened this recommendation, and its implementation will be subject to future interpretation. Yet, compared with previous forest planning efforts that had little protection of riparian habitats and none specifically for brown bears, this conclusion was an important measure for brown bear conservation.

Key Words: Alaska, brown bear, forest management, *Oncorhynchus*, salmon, Tongass National Forest, *Ursus arctos*.

CONTENTS

INTRODUCTION

Wildlife biologists interested in providing useful information for resource management decision-makers often find the link between science-based information and land allocation decisions to be a complex combination of political, regulatory, and conservation issues. Debates about the management of natural resources, especially in pristine ecosystems, have intensified in recent years. Many natural resource agencies are now striving to integrate research and management to assist with problems of uncertainty in ecosystem management decisions and to minimize future controversy with objective information (e.g., Thomas 1996, Christensen et al. 1996). The Tongass National Forest (Tongass) covers most of Southeast Alaska, and its management has been the source of significant debate. Much of the debate has focused on determining how much old-growth coniferous forest should be set aside to maintain habitats for viable wildlife populations and anadromous fish habitats versus allocation for timber harvest. Completion of the Land and Resource Management Plan (TLMP; USDA Forest Service 1997) for the Tongass National Forest in 1997 was the culmination of >10 years of planning. As part of this planning effort, scientists were involved in analyzing and synthesizing new information in a value neutral manner; this information was then provided to TLMP decision-makers (Everest et al. 1997). Most of the wildlife information was subject to peer review. For some species such as the brown bear, assessment panels were convened, and experts evaluated the risk of draft forest plan alternatives (Swanston et al. 1997).

Conservation of brown bears on the Tongass has received considerable attention over the past decade. This is because brown bears 1) are in very high densities in some portions of the Tongass (Schoen and Beier 1990; Titus and Beier 1993), 2) have high public interest for viewing and hunting (Titus et al. 1994), 3) have economic value (McCollum et al. 1996), and 4) are subject to conservation concerns associated with development activities (McLellan 1990). It is well recognized that pacific salmon are an important component in the annual cycle of coastal Alaskan and British Columbia brown bears (Hamilton and Bunnell 1987, Barnes 1989, Schoen and Beier 1990). Schoen and others believe that maintaining high brown bear densities may be linked to the conservation of forested riparian habitats (1994). The maintenance of forested buffers along anadromous fish streams is also recognized as important for the long-term health of salmon stocks (AFHA 1995). As the Tongass forest plan was being developed, we provided information to the science team and decision-makers about our research findings regarding brown bear use of salmon-spawning habitats and associated riparian areas. We report on brown bear use of riparian habitats and how well the preliminary scientific findings and subsequent land allocation decisions fit these data relative to the conservation of riparian habitats. Generally our goals are to demonstrate, using radiotelemetry, brown bear seasonal use of riparian forest areas, review the science component of the Tongass planning process, describe the riparian protection measures in the final plan, and determine the amount of protection afforded with our data.

OBJECTIVES

The scope of our project remained similar to that of the previous reporting period (Titus and Beier 1994). The main emphasis was to evaluate short- and long-term changes in brown bear populations as influenced by human-induced changes to their habitat and demography. Objectives include:

1. Evaluate long-term changes in the home ranges and centers of activity of selected brown bears in the vicinity of Greens Creek, Admiralty Island.

2. Evaluate the degree of site tenacity by female brown bears and their offspring to developed areas of Greens Creek.

3. Determine the extent to which brown bears exhibit short-term changes in home ranges or centers of activity as a result of logging activity on northeast Chichagof Island.

4. Determine seasonal and annual home ranges of selected brown bears, particularly in areas where data can be acquired both before and after road building and intensive logging activities.

5. Evaluate the interagency brown bear habitat capability model with independent data from northeast Chichagof Island.

6. Estimate annual survival and reproduction rates for brown bears on northeast Chichagof Island.

7. Determine the degree of population isolation of brown bears on northeast Chichagof Island.

8. Estimate the types of brown bear mortality on northeast Chichagof Island.

9. Use population projection models for evaluating the future status of brown bears on northeast Chichagof Island given differing demographic parameters.

10. Assess the seasonal distribution and habitat use patterns of brown bears on northeast Chichagof Island.

11. Determine the assocation between logging, logging camps, and associated development, and attributes of annual brown bear harvest in Southeast Alaska.

12. Develop management guidelines for intensive land development within Southeast Alaska brown bear range.

During this reporting period we focused on an analysis of brown bear radiotelemetry data to assist in the preparation of the Tongass Land Management Plan. Brown bear use of forested areas is of interest to land managers to ensure that viable and well-distributed populations remain across the Tongass National Forest. The Alaska Department of Fish and Game is interested in maintaining high numbers of brown bears sufficient to continue to ensure a variety of uses, including hunting and viewing. We performed various analyses to better understand seasonal use of forested riparian areas relative to alternatives proposed in the revision of the forest plan.

METHODS

FIELD METHODS

We captured, immobilized, (Taylor et al. 1989) and radiocollared 111 brown bears (37 males, 74 females) 141 times from October 1989 through October 1997, using methods standard for bear biologists. Subadult bears were fitted with beak-away radiocollars. From helicopters we made 73% of the captures by darting bears in rugged alpine habitats, mostly in June and early July when a large portion of the bear population were in this habitat type. We also captured 18% of the bears with footsnares at a local landfill or on well-used trails along salmon-spawning streams. We captured a few bears (9%) by shooting them with a dart gun at a local landfill. Over the 8-year-period, we believe we captured bears in representative habitats across the study area (Fig. 1) and that there was no bias with regard to capturing most bears in alpine habitats and subsequently assessing their riparian habitat use patterns.

We conducted aerial radiotelemetry flights at 5–14-day intervals from late April through early October. Methods followed those of Schoen and Beier (1990). Radiotelemetry

relocation points were plotted on 1:63360 topographic maps, and the points were then transferred to ortho-photo quads using an ArcView data entry system. Based on accuracy assessment trials from a nearby study area with similar terrain, Schoen and Kirchhoff (1983) estimated that their locations were within 24 m of the actual location. We believe that our cumulative errors are greater than this, but we did not incorporate error into our analyses.

Geographic Information System and Spatial Analysis

We acquired Tongass National Forest Geographic Information System (GIS) data layers for our spatial analysis. Important attributes included bear relocation data and spatially referenced information about streams and riparian buffer as programmed for the final TLMP (USDA Forest Service 1997). We acquired GIS maps of all of the anadromous fish streams from the study area and manually corrected the maps to reflect our best knowledge of the extent of spawning pink or chum salmon. The riparian standards and guideline buffers for TLMP (Table 1) are based on a complicated combination of stream channel types, stream class type, and soil characteristics. The riparian standards and guidelines are applied during the planning of an on-the-ground management activity (e.g., timber harvest) and our GIS data represent the best approximation of that riparian, no-cut buffer. These riparian buffers vary from 100 to >500 ft from a stream. The Tongass plan also has a standard and guideline requiring the establishment of 500-ft no-cut buffers along streams where there are important brown bear foraging sites. We used GIS to evaluate the number of brown bear relocations in various buffers. We captured 9 brown bears at the Hoonah landfill, a local concentration area for large male bears. 8 male and 1 female bear were eliminated from some of our analyses because these bears had different foraging patterns than other bears we studied.

We used English measurement units to describe buffers, consistent with Forest Service uses in planning and management.

RESULTS

We acquired 2069 relocations from 111 brown bears over 8 years, and our relocations were distributed across most watersheds in the study area. Results were skewed toward females (79% of relocations) because our ability to both recapture and maintain collars on females was greater and also because our study area probably has a population skewed toward females. We had 21 females and 1 male for which we had >30 relocations. Most of our aerial telemetry data were acquired from April through October (April 6%, May 10%, June 14%, July 13%, August 30%, September 16%, and October 10%).

Riparian Habitat Use

We had 2 types of data to demonstrate brown bear use of riparian habitats. We visually estimated 23 habitat types per relocation and also acquired riparian habitat information using GIS and Forest Service riparian buffers. Based on the visual assessment of habitat type, 15.5% of the relocations were in riparian habitats across all seasons, and 62.9% (202 of 321) were during the month of August. Our results follow the seasonal patterns in

habitat use by Southeast Alaska brown bears described by Schoen and Beier (1990). The combination of riparian and old-growth forest habitat types accounted for 59% (373 of 629) of August relocations. In the month of May, only 2% (4 of 199) of the relocations were in riparian habitats. Thirty-six of 38 relocations were in streams during July, August, and September. In addition to the seasonal high use of old-growth forests and riparian areas, our radiocollared brown bears used avalanche chutes extensively. Bear use of avalanche chutes was most frequent during September when 44% (145 of 331) of all relocations were in this habitat type. By mid-September most brown bears were no longer associated with salmon streams, and they had moved up in elevation to feed on ripening currants (*Ribes bracteosum*), salmonberries (*Rubus spectabilis*) and other vegetation.

Use of Riparian Areas and Salmon Stream Buffers

The northeast portion of Chichagof Island contains >25 salmon-spawning streams (Fig 1.), and all areas were buffered in the GIS for these analyses, including non-Forest Service lands. We assumed that bear relocations that were within a buffer afforded some level of protection to bear habitat and that these buffers were "important" for the conservation of bears. The greatest number of relocations in riparian buffers occurred in August when the highest proportion of bears were near salmon streams (Fig 2.). The riparian standard and guideline buffers are usually narrower than the prescription of a 500-ft brown bear buffer along all streams that have spawning salmon; consequently, they had fewer bear relocations in them. Of August brown bear relocations, 24% (excluding Hoonah-landfill bears from the analysis) were in the riparian standard and guideline buffer and 39% were in the 500-ft brown bear buffer. The theoretical 1000-ft buffer had 46% of all August relocations in it.

We also examined the proportion of relocations within the 500-ft brown bear buffer from 15 July through 15 September for bears with >10 relocations (Fig 3.). Of the 42 bears that met this criteria, 3 were never within this buffer, indicating that a few brown bears make little or no use of salmon (Schoen and Beier 1990, Hilderbrand et al. 1996, K. Titus and L. Beier unpubl. data). Twenty-four percent (10 of 42) had = 50% of their relocations within this buffer, and 3 bears were in the buffer >75% of the time.

DISCUSSION

Bear Use of Administrative Buffers

Studies in open habitats have thoroughly documented brown bear high use of riparian areas during late summer in association with spawning salmon (e.g., Gard 1971). However, in forested areas radiotelemetry has been useful to document the high use of forested areas adjacent to salmon spawning streams. The riparian standard and guideline buffers and a blanket buffer of 500 feet on all salmon-spawning streams provided different levels of protection to brown bears during late summer when most bears were in lowland old-growth and riparian habitats (Fig. 2). Our analysis indicated that the 500-ft buffer had 15% more relocations than the riparian standard and guideline buffer during the peak period of the salmon run from 15 July through 15 September.

This protection is based on a few assumptions. First, we assumed there was no error in our radiotelemetry data and that the buffers were correctly mapped. The 500-ft buffers were mapped based on the authors' first-hand knowledge of the study area and modification of the Forest Service's GIS class I anadromous fish streams to include only those portions of the stream where salmon actually spawned. Errors were probably small for this application, but they would increase when applied on the Tongass away from our research study area. The riparian standard and guideline buffer was more problematic to apply in terms of its representation to reality. The Forest Service, along with other agency experts, crafted a complicated riparian standard and guideline that will have some error when translated from the GIS map to its application in the field. Because this riparian standard and guideline is new and complicated, it remains to be determined what the exact size of the buffer will be for all of the streams in a watershed. Second, we assumed that the buffers could actually be allocated on the ground. In reality, some streams on the study area either have no streamside buffers or the buffers are much smaller than the analyses we performed here. As a result, the level of streamside protection afforded by the new TLMP can only provide these buffers from 1998 forward.

There was an assumption that the high use of riparian habitats is associated with a cause/effect relationship between maintaining viable and well-distributed brown bear populations and protecting forested riparian habitats. The brown bear risk assessment panel adopted this assumption (Swanston et al. 1996; TLMLP administrative record 1997), and fisheries biologists consider riparian habitats critical to maintain long-term health of salmon stocks (e.g., AFHA 1995). Evidence also exists that brown bear high densities are closely associated with coastal areas and access to spawning salmon (Miller et al. 1997).

Risk Assessment Panels

The Forest Service used a modified "Delphi" approach with species or ecosystem experts to estimate the level of risk to specific wildlife resources and socioeconomic conditions when implementing the various management alternatives in the draft TLMP (Swanston et al. 1996). In addition to expert panels for the brown bear, there were panels for the northern goshawk (*Accipiter gentilis*), marten (*Martes americana*), wolves (*Canis lupus ligoni*), Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) and "other" mammals. A fish and riparian panel was also held to integrate a variety of aspects associated with protection of riparian habitats. Each of these panels was conducted independent from one another and had the aid of a local species or topic expert. We were the species experts for the brown bear and provided an in-depth review of our brown bear studies on Admiralty and Chichagof islands. A key finding of the brown bear risk assessment panel was that "an undisturbed buffer (no harvest, no roads) along salmon-bearing streams where bears concentrate and feed helps to maintain brown bear habitat. Such buffers provide some isolation of bear-feeding sites from humans and other bears." The panel identified 500 feet (152 m) along each side of salmon bearing-streams as an appropriate buffer width (Swanston et al. 1996). The brown bear risk assessment panel was concerned about the long-term health of salmon habitat, because they felt that salmon habitat was important for brown bear populations. The presence of roads and access was also important to the

panel because of 1) increased sediment delivery to salmon streams, decreasing stream productivity and 2) increased human access to bear habitat, increasing bear mortality rates.

The assessment panel evaluated risks to brown bears based on a threshold of maintaining viable and well-distributed habitats for brown bear populations across the Tongass. Other agencies such as the state of Alaska have a mandate to manage for sustainable and usable populations, a level much higher than *minimum viable*. It has been argued that the minimum viable criteria may be inappropriate as a management strategy and that other approaches should be taken (Conner 1988, Grumbine 1990).

USE OF INFORMATION

There was an evolution in the application of scientific information about brown bear use of riparian areas by those deciding how it would be used in the Tongass plan. Verbiage changes between the draft and final forest plan indicate how the risk assessment panel and their review helped shape the final decision in the forest plan. The Revised Supplemental Draft Environmental Impact Statement for the Tongass in 1995 was produced before the brown bear risk assessment panels were convened. In that draft the bear habitat management section had no specific distances suggested for protection of riparian buffers at brown bear foraging sites. The draft stated "maintain a buffer of productive old-growth forest on both sides of important and traditional brown bear foraging habitats to provide cover during feeding, among bears and between bears and humans. These are generally Class I anadromous fish streams ...." As mentioned above, the brown bear risk assessment panel clearly provided a distance recommendation, and a review of the record from the panel assessment indicated that a measurable distance was very important to the panelists. Iverson and Rene (1997) reviewed the conceptual approaches for maintaining viable and well-distributed wildlife populations across the Tongass as part of the planning process and to meet the obligations of the National Forest Management Act. They indicated that a key parameter for brown bears based on their viability synthesis was the maintenance of "300-ft buffers on low-gradient class I streams to provide visual barrier and foraging habitat." This information was initially compiled in 1995. Although initially intended to meet just once, the brown bear risk assessment panel met twice, once in January 1996 and again in March 1997. The brown bear panel was reconvened to assess the likelihood that the Final Environmental Impact Statement preferred alternative would provide sufficient habitat to support a viable and well-distributed brown bear population across their historic range, spanning the Tongass. The 1997 panel revisited the issue of riparian management, and they "reiterated their concern for a minimum 500-ft no harvest/no road buffer around brown bear feeding areas. This concern was based largely on available telemetry data. One panel member strongly recommended a 1000-ft no harvest/no road buffer around brown bear feeding areas until completion of further telemetry data collection and analysis." (USDA Forest Service 1997; planning record). Concern was expressed by some of the brown bear experts that the Forest Service was changing the burden of proof and weakening the suggestions of the panel. The final Tongass plan Record of Decision was published in July of 1997 and stated:

> "During project planning, evaluate the need for additional protection of important brown bear foraging sites (e.g., waterfalls used as fishing sites) in addition to the buffers already provided by the Riparian and Beach & Estuary Fringe Forestwide standards & Guidelines, and the Old-growth Habitat and other natural setting Land Use Designations. Establish forested buffers, where available, of approximately 500 feet from the stream sites where, based upon the evaluation, additional protective measures are needed to provide cover among bears while feeding, or between brown bears and humans. This may be especially important on Class I anadromous fish streams within the Moderate Gradient/Mixed Control and Flood Plain process groups where a large amount of bear feeding activity on salmon occurs. Consider the combination of bear foraging behavior, stream channel types, and adjacent landform to help identify probable important feeding sites. Consult the Alaska Department of Fish and Game in identifying and managing important brown bear foraging sites."

We determined brown bear use of the 500-ft buffer by assuming that it would be applied completely across the study area and that the complete lengths of all salmon spawning streams were important for brown bears. This is our interpretation of the brown bear standard and guideline in the final Tongass forest plan. We anticipate that others may have different interpretations of how completely this standard and guideline should be applied. As indicated from our results (Fig. 2), the risk to brown bears will increase should this buffer be applied only in a few areas. Because of brown bear high density on our study area, and across all of Baranof and Chichagof islands available for timber harvest, we believe that nearly all of the salmon-spawning streams are important for brown bears.

ACKNOWLEDGMENTS

The Alaska Department of Fish and Game and the Federal Aid in Wildlife Restoration Program primarily funded this study. The Alaska Region of the US Forest Service provided financial assistance from 1989–1993, and their support was instrumental in initiating this study. We appreciate the support from the Hoonah Ranger District during the early years of this study. J. Schoen and D. Anderson provided useful advice during the study's initial phases. G. Fisher of the US Forest Service provided valuable assistance with GIS programming; his ability to provide the various data layers made our results possible. G. Pendleton and R. Flynn provided assistance and guidance with data analysis. We appreciate the assistance of other ADF&G staff with fieldwork. L. Bennett and other fixed-wing pilots provided safe flying. Finally, we acknowledge the long-term, skilled assistance of helicopter pilot B. Englebrecht for his evening capture trips and for bringing us home safely

LITERATURE CITED

ANADROMOUS FISH HABITAT ASSESSMENT TEAM [AFHA]. 1995. Report to Congress: anadromous fish habitat assessment. R10-MB-279. Juneau, AK. US Department of Agriculture, Forest Service, Pacific Northwest Research Station; Alaska Region.

Barnes, V. G., Jr. The influence of salmon availability on movements and range of brown bears on southwest Kodiak Island. International Conference on Bear Research and Management. 8:305–311.

CHRISTENSEN, N. L. (Chair), et al. 1996. The report of the Ecological Society of America committee on the scientific basis for ecosystem management. Ecological Applications 6:665–691.

CONNER, R. N. 1988. Wildlife populations, minimally viable or ecologically functional? Wildlife Society Bulletin 16:80–84.

EVEREST, F. H., D. N. Swanston, C. G. Shaw III, W. P. Smith, K. R. Julin, and S. D. Allen. 1997. Evaluation of the use of scientific information in developing the 1997 forest plan for the Tongass National Forest. General Technical Report PNW-GTR-415. Portland, OR: US Department of Agriculture, Forest Service, Pacific Northwest Research Station. 69p.

GARD, R. 1971. brown bear predation on sockeye salmon at Karluk Lake, Alaska. Journal of Wildlife Management 35:193–204.

GRUMBINE,R. E. 1990. Viable populations, reserve size, and federal lands management: a critique. Conservation Biology 4:127–134.

HAMILTON, A. N. and F. L. BUNNELL. 1987. Foraging strategies or coastal grizzly bears in the Kimsquit River valley, British Columbia. International Conference on Bear Research and Management 7:187–197.

HILDERBRAND, G. V., S. D. FARLEY, C. T. ROBBINS, T. A. HANLEY, K. TITUS and C. SERVHEEN. 1996. Use of stable isotopes to determine diets of living and extinct bears. Canadian Journal of Zoology 74:2080–2088.

IVERSON, G. C., and B. RENE. 1997. Conceptual approaches for maintaining well-distributed, viable wildlife populations: A resource assessment. Pages 1-23 *in* K. R. Julin, compiler. Assessments of wildlife viability, old-growth timber volume estimates, forested wetlands, and slope stability. General Technical Report. PNW-GTR-392. Portland, Oregon. US Department of Agriculture, Forest Service, Pacific Northwest Research Station. 58.

MCLELLAN, B. N. 1990. Relationships between human industrial activity and grizzly bears. International Conference on Bear Research and Management 8:57–64.

McCOLLUM, D. W., S. M. MILLER, P. JANIK and K. TITUS. 1996. Implications of economic information for natural resource managers: an Alaskan case study. Pages 257–266 *in* Transactions of the 61st North American Wildlife and Natural Resources Conference.

MILLER, S. D., G. C. WHITE, R. A. SELLERS, H. V. REYNOLDS, J. W. SCHOEN, K. TITUS, V. G. BARNES, Jr. R. B. SMITH, R. R. NELSON, W. B. BALLARD and C. C. SCHWARTZ. 1997. Brown and black bear density estimation in Alaska using radiotelemetry and replicated mark-resight techniques. Wildlife Monographs 133:1–55.

SCHOEN, J. W., and M. D. KIRCHHOFF. 1983. Seasonal distribution and habitat use by Sitka black-tailed deer in southeastern Alaska. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Progress Report. Project W-22-1. Juneau, AK.

———. and L. R. BEIER. 1990. Brown bear habitat preferences and brown bear logging and mining relationships in Southeast Alaska. Research Final Report. Federal Aid in Wildlife Restoration. Alaska Department of Fish and Game. Juneau, AK.

———, R. W. FLYNN, L. H. SURING, K. TITUS and L. R. BEIER. 1994. Habitat-capability model for brown bear in southeast Alaska. International Conference on Bear Research and Management. 9:327–337.

SWANSTON, D. N., C. G. SHAW III, W. P. SMITH, K. R. JULIN, G. A. CELLIER, and F. H. EVEREST. 1996. Scientific information and the Tongass Land Management Plan: Key findings from the scientific literature, species assessments, resource analyses, workshops, and risk assessment panels. General Technical Report PNW-GTR-386. Portland, OR: US Department of Agriculture, Forest Service, Pacific Northwest Research Station.

TAYLOR, W. P., Jr., H. V. REYNOLDS III, and W. B. BALLARD. 1989. Immobilization of grizzly bears with tiletamine hydrochloride and zolazepam hydrochloride. Journal of Wildlife Management 53:978–981.

THOMAS, J. W. 1996. Forest Service perspective on ecosystem management. Ecological Applications 6:703–705.

TITUS, K., J. N. TRENT, L. D. AUMILLER, J. H. WESTLUND and M. SIGMAN. 1994. Managing brown bears as both game and nongame: past experience and future prospects. Pages 353–362 *in* Transactions of the 59th North American Wildlife and Natural Resources Conference.

TITUS, K., and L. R. BEIER. 1993. Population and habitat ecology of brown bears on Admiralty and Chichagof islands. Federal Aid in Wildlife Restoration Research Progress Report. Alaska Department of Fish and Game. Study 4.22 Project W-24-1. Juneau, AK.

USDA FOREST SERVICE. 1997. Land and resource management plan – Tongass National Forest. Alaska Region. R10-MB-338pp. Juneau, AK.

WILLSON, M. F, and K. C. HALUPKA. 1995. Anadromous fish as keystone species in vertebrate communities. Conservation Biology 9:489–497.

SUBMITTED BY:

Kimberly Titus
Regional Supervisor

LaVern R. Beier
Fish and Wildlife Tech V

APPROVED BY:

Wayne Regelin, Director
Division of Wildlife Conservation

Steven R. Peterson, Senior Staff Biologist
Division of Wildlife Conservation

SUBMITTED BY:

Kimberly Titus
Regional Supervisor

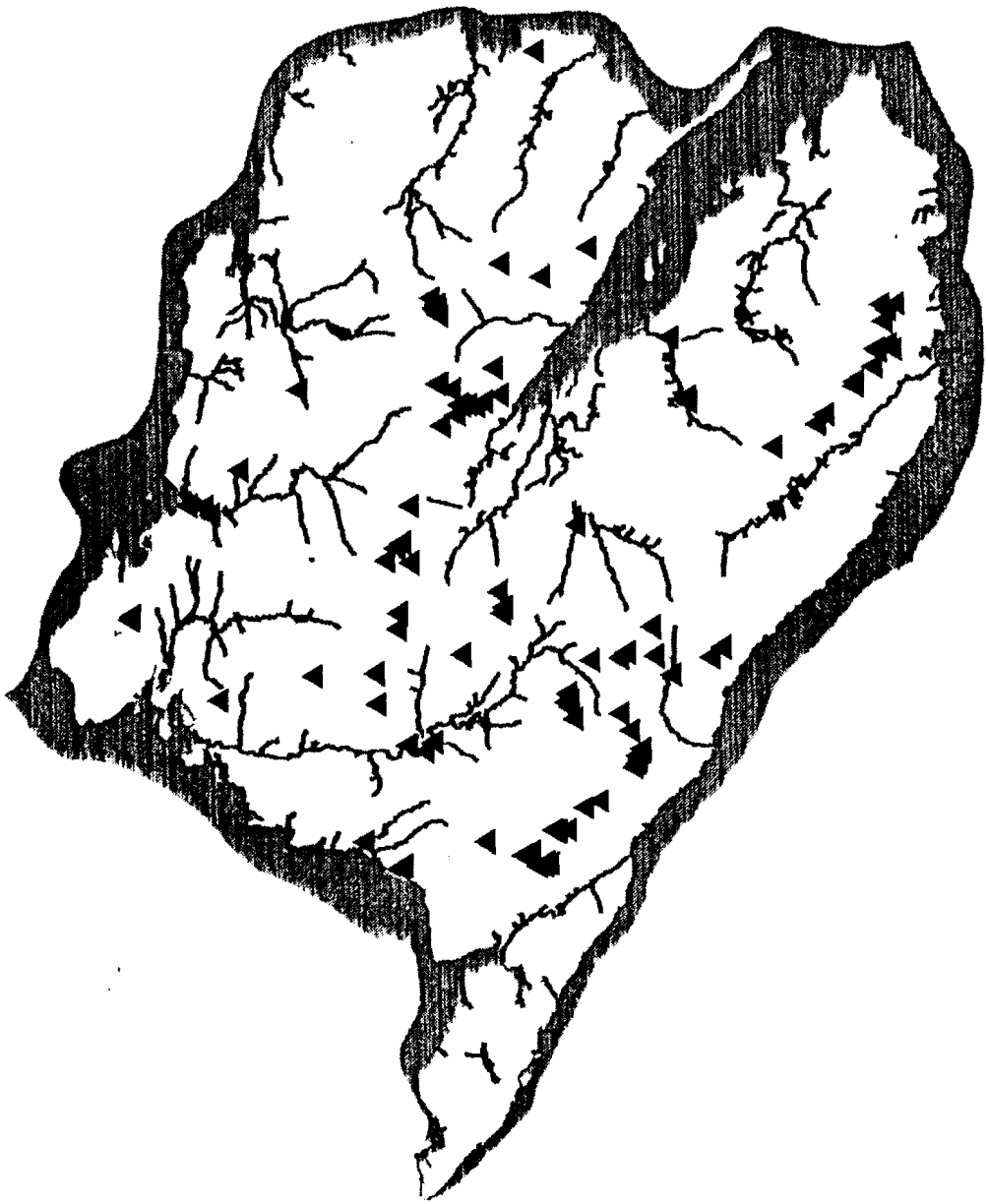

Fig. 1 Brown bear capture locations (triangles) and anadromous fish (salmon spawning) streams on the northeast portion of Chichagof Island, Alaska. Some triangles represent >1 capture location.

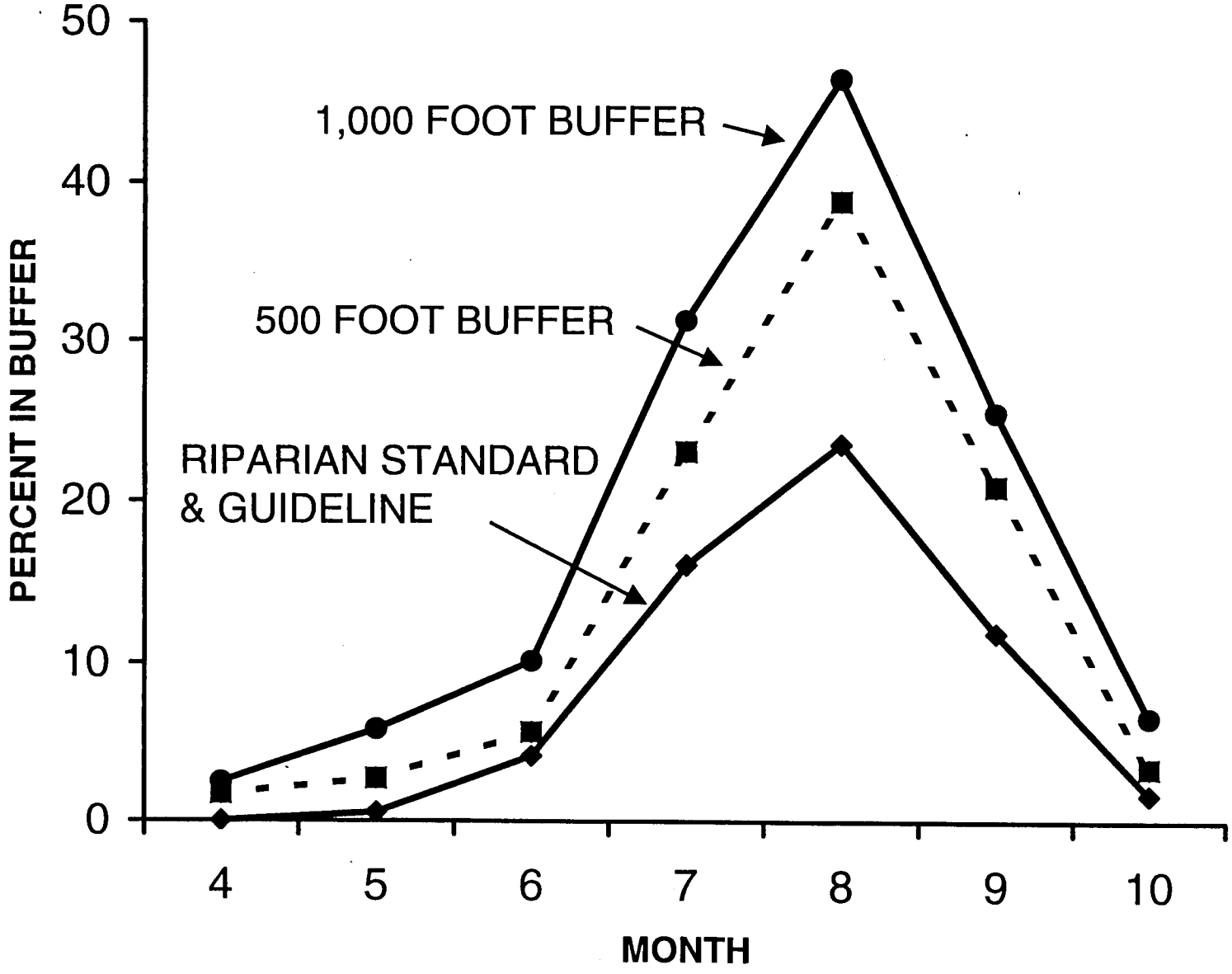

Fig. 2 Percent of pooled brown bear radiotelemetry relocations (n = 102 bears; 1935 relocations) in 3 types of stream buffers on the Tongass National Forest, Alaska, based on a geographic information system analysis. The riparian standard and guideline buffer and the 500-ft brown bear feeding area buffers are part of the 1997 Tongass Land and Resource Management Plan. The 1000-ft buffer is hypothetical. Brown bears captured or using the Hoonah landfill were eliminated from this analysis.

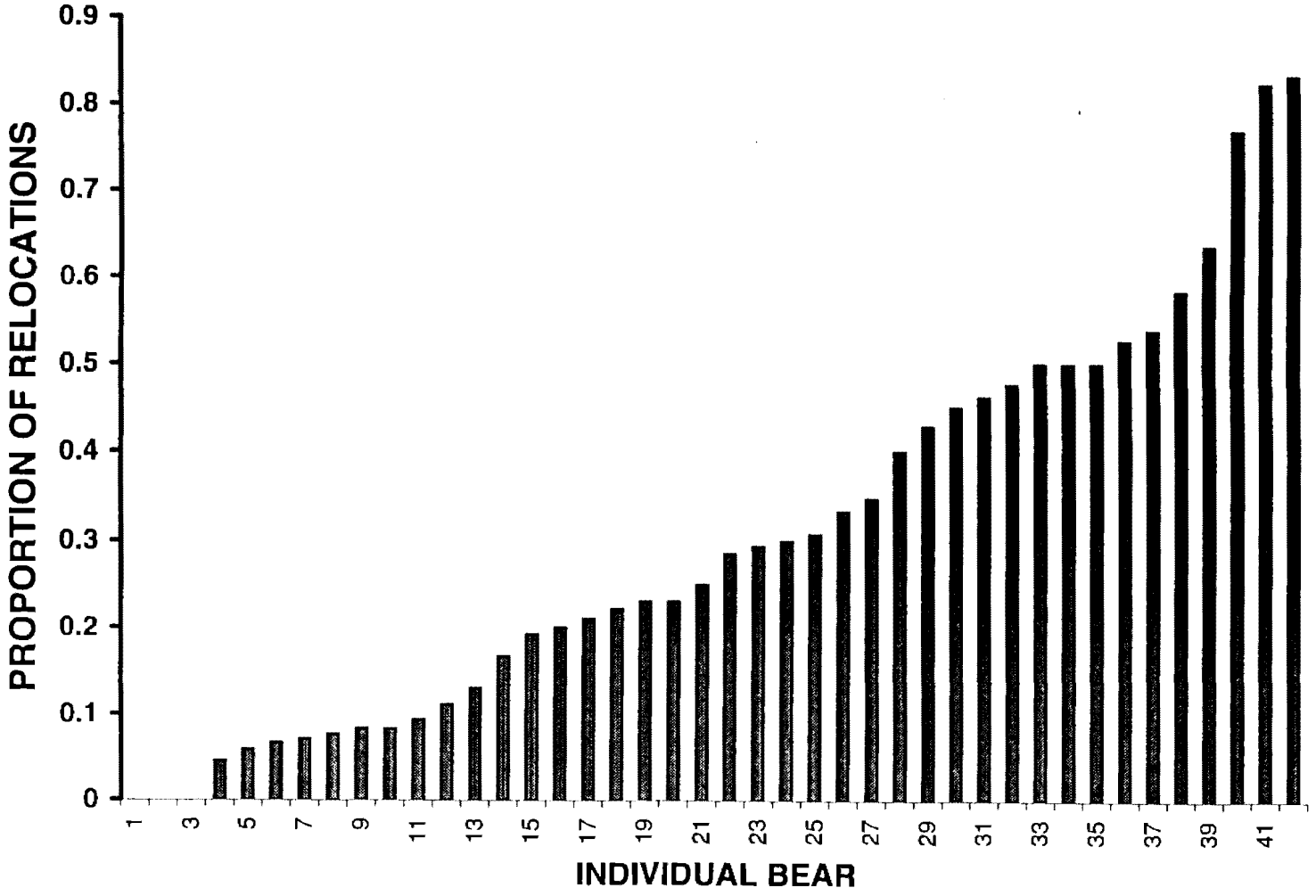

Fig. 3 Proportion of individual brown bear radiotelemetry relocations (n = 42 bears; 735 relocations) within 500 feet of salmon spawning streams from 15 July–15 September, Chichagof Island, Alaska. Only individuals with >10 relocations during this period are shown. Brown bears captured or using the Hoonah landfill were eliminated from this analysis.

Table 1. Riparian management prescriptions used determine the size of no-cut streamside buffers on the Tongass National Forest, Alaska and the proportion of brown bear radiotelemetry relocations in each buffer.

Management Guideline	Description	% relocations within buffer during August	% relocations within buffer during July, August and September
Tongass Timber Reform Act	100 feet on each side of Class I – anadromous fish streams	Not Calculated; buffer too small given telemetry errors	Not Calculated; buffer too small given telemetry errors
Riparian Standards & Guidelines	Uses different sizes of buffers dependent on stream channel type (e.g., alluvial fan, floodplain, high gradient contained), stream class type (e.g., class II – anadramous fish streams, Class IV – intermittent and small perennial channels), and soil type characteristics. Varies from <100 – 600 feet	23.5	18.7
Brown bear Buffer	"…evaluate the need for additional protection of brown bear foraging sites in addition to the buffers already provided by Riparian and Beach & Estuary Fringe Forest-wide standards and guidelines . . . "Establish forested buffers, where available, of approximately 500 feet from the stream"	38.9	30.5
1,000 Buffer	Not part of forest plan	46.4	38.6

The Federal Aid in Wildlife Restoration Program consists of funds from a 10% to 11% manufacturer's excise tax collected from the sales of handguns, sporting rifles, shotguns, ammunition, and archery equipment. The Federal Aid program allots funds back to states through a formula based on each state's geographic area and number of paid hunting license holders. Alaska receives a maximum 5% of revenues collected each year. The Alaska Department of Fish and Game uses federal aid funds to help restore, conserve, and manage wild birds and mammals to benefit the public. These funds are also used to educate hunters to develop the skills, knowledge, and attitudes for responsible hunting. Seventy-five percent of the funds for this report are from Federal Aid.

Margaret Edens