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A Method for Quantifying Environmental Indicators of Selected Leisure Activities in the United States

A METHOD TO QUANTIFY ENVIRONMENTAL INDICATORS OF SELECTED LEISURE ACTIVITIES IN THE UNITED STATES

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FORWARD

EPA is pleased to present this study, the first of its kind to develop environmental indicators for the many industries that comprise the tourism and recreation sector. Historically, EPA has not focused a great deal of its effort either on the service sector or on tourism and recreation industries. This report establishes a foundation of knowledge with the hope of promoting constructive dialogue and innovative solutions to advance environmentally sustainable travel, tourism, and recreation.

In preparing this report, EPA solicited the perspectives of a variety of organizations and people. We value these partnerships and considered the wide range of views before issuing this final report. Important contributions were made by numerous businesses; environmental and community organizations; academia; and federal, state, and local governmental organizations.

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EXECUTIVE SUMMARY

The study is an initial step by the U.S. Environmental Protection Agency to quantify the environmental impacts of leisure activities. It is part of a larger effort at EPA to assess the environmental impacts of important economic sectors and to understand how the technical, economic, and institutional constraints of companies and organizations contribute to those impacts. EPA's ultimate goal is to forge on-going sector partnerships that support continuous improvement in the environmental performance of industry sectors.

For the purposes of this study, "leisure activities" are defined as the sum of tourist activities and recreational activities undertaken buy the American Public. "Tourism" refers to recreational activities by participants who travel at least 50 miles from home or spend at least one night away from home. "Recreation" describes activities close to the participant's home. Although it is not commonly thought of as a leisure activity, we also include business travel because it is commonly considered part of tourism.

Leisure activities generate a significant and growing share of U.S. economic activity. In 1997, direct spending on leisure activities - tourism, recreation and business travel - was between $436 billion and $512 billion, according to our calculations based on data published by the Bureau of Economic Analysis. In 1997, tourism expenditures

represented between 3.3% and 4.1% of the U.S. Gross Domestic Product. From 1992 to 1997 tourism spending grew at an average annual rate of 6.9% while the gross domestic product (GDP) grew at an average annual rate of 5.6%.[1] Spending on leisure activities is expected to continue to grow both in absolute terms and as a portion of the economy as a whole.

Leisure activities are closely tied to the natural environment. Natural attributes such as lakes, beaches, mountains, or wilderness are often the foundation of local and regional tourism and recreation businesses. However, large numbers of visitors can overwhelm the ability of local infrastructures and ecosystems to supply resources and process wastes. The environmental impacts from tourists and recreationists can damage or even destroy the natural attributes that tourism and recreation depend on. Careful management and planning, based on an understanding of the economic and environmental impacts of leisure activities, can support development that is both economically and environmentally sustainable.

In this study, we develop a methodology for quantifying environmental impacts of specific leisure activities, which may then be compared among the activities or compiled to give a broader measure of impacts from the sector as a whole. This "bottom up" method was chosen because of the wide variety of leisure activities. We further separated the impacts of the activities themselves from the impacts of supporting businesses such as transportation, lodging, restaurants, and retail.

We applied this methodology to ten specific leisure activities. These activities are only a portion of the overall leisure activities sector. They were chosen because data were available for them and because together they represent a significant portion of the spending in the sector. The activities are: skiing, fishing, hunting, boating, golfing, casino gambling, amusement/theme parks, historic places and museums, conventions

[1] *Survey of Current Business*, July 2000.

and conferences, and waterside recreation (which includes any visits to freshwater or the coast for the primary purpose of being near the water, e.g. for swimming but not including fishing or boating).

We measured the environmental impacts of these ten leisure activities according to nine environmental indicators: water use, biological oxygen demand of wastewater, total suspended solids in wastewater, energy use, air pollution (hydrocarbons, carbon monoxide, nitrogen oxides), greenhouse gas emissions, and municipal solid waste generation. The economic impacts of the activities were measured by the single indicator of direct spending by participants.

Highlights of our results are:

- In general, the amount of hotel lodging is the most important factor in determining water and energy use. Exceptions arise when specific activities require significant quantities of water (e.g., skiing and golf) or electricity use.

- Quantities of municipal solid waste generated are closely tied to the number of meals in restaurants that can be attributed to a specific activity.

- In general, air emissions for activities are determined primarily by the number and length of automobile trips taken by participants. One exception is boating activity which has high air emissions arising from boat engines.

- Greenhouse gas emissions are strongly influenced by the distance traveled and by the number of nights at a hotel. High greenhouse gas emissions from these support activities are a result of the relatively intense use of fuel and electricity, respectively.

This study has several limitations. First, not all leisure activities are included in the model. Second, our results are reported on a national level. The actual effects on local ecosystems will depend on the initial health, sensitivities, and other stressors of those ecosystems. Third, the model and the results give total, rather than net impacts, of recreational and tourist activities. For example, we do not compare these impacts to the impacts of, say, staying home and watching TV or staying with friends or relatives. With the exception of greenhouse gas emissions, which are quantified for electric energy production, the model does not quantify indirect environmental indicators of tourism and recreation, for example, the impacts of new roads built to accommodate visitors. Indirect economic effects are also not included. Future work could overcome these limitations.

EPA began this study to better understand the size and nature of the economic and environmental impacts of tourism and recreation, and to establish a baseline for measuring the impacts in the future. In doing this we have compiled an extensive database of information on these industries, and we have developed a tool for analyzing the data. It is our hope that others interested in this sector will build on this work to foster the sustainable development of tourism and recreation industries.

1. INTRODUCTION AND BACKGROUND

The overarching purpose of this report is to establish a foundation of knowledge to help understand the environmental impacts of selected leisure activities. EPA intends to stimulate dialogue and generate interest in the environmental issues surrounding these activities. We hope this study will highlight potential environmental problems and opportunities and contribute to future studies that would further help to promote the sustainability of tourism and recreation activities. With a common starting point, interested parties can then embark in designing and implementing solutions.

This study provides a basis for beginning a long-term effort to develop a comprehensive set of information on tourism and recreation industries. It is an initial step by the EPA to learn more about a portion of the U.S. economy that is significant and growing quickly and has the potential for wide-ranging environmental impacts. The report starts by describing what is meant by tourism and recreation, followed by brief descriptions of potential environmental impacts, then a description of the methodology developed to represent some of the environmental impacts, and finally a presentation of some preliminary findings using this methodology.

The term “leisure activities” encompasses large portions of the travel, tourism and recreation industries. For the purposes of this study, recreational activities carried out

close to home would be considered "recreation." The same activities carried out away from home would be considered tourism. Specifically, recreational activities carried out more than 50 miles from home or involving at least one overnight stay away from home are considered to be tourism. This definition of tourism is used by the Bureau of Economic Analysis (BEA) and the Travel Industry Association. Business travel is also considered a type of tourism by this definition.

Americans spend enormous sums of money pursuing leisure activities: engaging in recreational activities, traveling to sites, staying overnight, eating out, and shopping. The full economic impact of leisure activities is difficult to estimate. The Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce estimates that between $278 and $343 billion, or between 3.3% and 4.1% of the U.S. Gross Domestic Product comes from expenditures on tourism. Business travel in the United States contributes another $115 and $119 billion, and local recreational expenditures add between $43 and $50 billion. All together, direct spending on U.S. tourism and recreation in 1997 was estimated at roughly $436 and $512 billion.[2]

Tourists' expenditures support many businesses. These businesses pay taxes, purchase materials and hire employees, who, in turn, make additional expenditures. When these multiplier effects are added to the economic picture, we can conclude that spending on tourism accounts for between $1.2 trillion and $ 1.4 trillion in the United States.[3] By all estimates the leisure sector, comprised in large part of tourism and recreation businesses, is economically significant and increasingly so. In 1997, the tourism industry grew at 6.9% per year, 1.3% faster than the U.S. economy.[4]

[2]Survey of Current Business, July 2000

[3]Memo from Jared Creason, US EPA, dated December 7, 2000.

[4]Survey of Current Business, July 2000

Tourism and recreation are closely tied to local environmental conditions. While they depend on the quality of the environment, they can also result in a host of environmental problems. Poorly planned development can damage the natural environment. Large numbers of visitors can overwhelm the ability of local infrastructures and ecosystems to provide amenities and process wastes. State and local governments are increasingly taking steps to avoid or minimize these effects by using prevention and control options, such as land use plans; environmental impact assessments; legislative, regulatory, and enforcement measures; training and education; research and monitoring; and community partnerships (USEPA, 1995).

> The National Park Service estimates that $10 billion in direct and indirect expenditures, as well as 200,000 jobs, were created by the 273 million visits in 1993 to National Parks alone (NPS, 1997). In addition, the National Park Service estimates that park visits each year contribute $5.5 billion annually to local economies. When visits to land managed by other agencies, state and local parks, and private recreation areas are taken into consideration, the National Park Service estimates that these expenditures exceed $22 billion (ORCA/SGMA, 1995).

Because of the importance of tourism and recreation to the nation's quality of life and economy, and because environmental protection plays a critical role in sustaining recreation resources, the EPA is working to identify and assess the interrelationships among the environment, recreation and economic health, and to educate industry, governments and recreation participants about these links (USEPA, 1995). EPA hopes these efforts will lead to continued and expanded partnerships among EPA, industry, and communities aimed at increasing revenue while decreasing environmental impacts.

EPA does not intend to use this study as a basis for federal regulation of the tourism and recreation sector. While EPA's regulatory programs have greatly improved the environmental performance of U.S. industry over the past 30 years, limitations to this process have become apparent. Traditional regulatory programs are often seen as

complex and costly, and may not apply to many areas of the service sector, such as tourism and recreation industries addressed in this study.

The study was developed by the Sustainable Industries Partnership Program, a new approach to environmental policy development that works outside the traditional command-and-control regulatory process. The Program is based on the premise that by studying an industry in close cooperation with its decision-makers, EPA can gain a better understanding of the reasons why businesses embrace or resist actions to protect the environment. Knowing why and how business decisions are made in an industry sector can help EPA shape policies that offer incentives for exceptional performance and overcome obstacles to success. The result is an agenda -- for government, industry, and others -- leading to long-term environmental improvement by businesses acting in their own self- interest. In the end, the Sustainable Industries Partnership Program seeks to help industry sectors improve their environmental performance while easing the costs and burdens of regulation.

The tourism and recreation sector is one of several industries that have been identified as likely to benefit from a sector-based approach. To date, EPA has not examined these industries in great depth and significant information gaps exist. This is due in part to the size and complexity of the sector which is actually comprised of numerous industries dispersed throughout the economy. Tourism and recreation can claim a share of the economic outputs (and environmental impacts) of many industry sectors, including, but not limited to, transportation, communications, power, wholesale and retail trade, hospitality, agriculture, ranching, commercial fishing, manufacturing and construction. While there are relevant databases from several industry trade associations and government agencies, these sets of data have never been consolidated to provide information for macro-level analysis of the sector.

Prior and Related Efforts

Industry, government and academic analysts have studied the tourism industry from many different perspectives. Their efforts have focused primarily on assessing and forecasting the economic impacts of the tourism industry on specific geographic areas. They have developed many models over the years that account for the direct and indirect expenditures of tourists and recreationists in a region or nation.

More recently, analysts have begun to study the environmental impacts of tourism and recreation industries. In this study we develop and use environmental indicators to assess the impacts of selected leisure activities. The approach described in this report, while unique, has built upon a number of the prior efforts described below.

A 1998 study by the German Federal Ministry of the Environment, *On the Way to Sustainable Tourism: How Much Environment is Travel Going to Cost Us?,* examined the environmental impacts of many tourism and recreation industry supply sectors. It also identified leisure-time activities such as skiing, boating and theme parks that have significant environmental impacts. However, unlike EPA's approach described here, it did not quantify outputs of these activities.

EPA's 1995 study, *Indicators of the Environmental Impacts of Transportation*, developed national estimates of the magnitude of transportation's impacts on the natural environment. This study compiled data on all primary modes of transportation (highway, rail, aviation, and maritime transport) and all environmental media (air, water and land resources), and covers the full "life-cycle" of transportation. The report presents a useful framework for developing various indicators of environmental performance for the transportation sector.

The World Tourism Organization (WTO) Environment Committee has developed indicators for the tourism industry. The WTO's *Indicators for the Sustainable*

Management of Tourism are designed for use in assessing the sustainability of a nation's tourism industry or the sustainability of tourism at the local level. The indicators cover those factors that are most relevant to tourism industry decision-makers such as site stresses, infrastructure capacity, endangered species, use and travel intensity, key resource consumption, tourist to resident ratios, and environmental controls and planning procedures in place.

The U.S. Travel and Tourism Satellite Accounts (TTSA) provide a useful structure for analyzing information on specific economic activities outside the structure of the traditional accounting systems. The satellite accounting standards use the Standard Industrial Classification of Tourist Activity (SICTA) to account for the numerous sectors supplying the industry. In this study we used the SICTA to help identify and define those tourism and recreation supply sectors that directly impact the economy and environment and to quantify the expenditures of these sectors.

2. SCOPE OF STUDY: LEISURE ACTIVITIES

This study examines the environmental impacts of selected leisure activities in order to improve our understanding of important and growing sectors of the U.S. economy. It is not a guide for legislative or regulatory policies, but rather a framework for analysis and exploration. Leisure activities is a broad term that includes outdoor and indoor leisure activities carried out near home and away from home. For the purposes of this study, leisure activities' participants include tourists, business travelers, and local recreationists.

EPA considered several definitions of tourism and recreation when determining the scope of this study. For example, the Travel Industry Association of America (TIA) focuses exclusively on activities in which travel is involved, and defines a traveler as a person who takes "a trip of 50 miles or more, one way, away from home or stay[s] an overnight and returns."[5] (TIA's Travel Scope®) This travel-dependent definition is useful in representing the importance of tourism for communities wishing to attract outside economic resources, but it would lead to an underestimation of environmental impacts associated with selected leisure activities by excluding local recreational participants. As a result, this study examines both tourism and recreation activities and their associated travel.

[5]Throughout this report, EPA uses the word "trips" to refer to all trips regardless of distance travelled including excursions of less than 50 miles each way.

The indicators were selected because they represent resource uses and environmental impacts that can affect the natural environment. The indicators were calculated for both tourists (who travel to participate in the activity) and local participants. For tourists, the indicators include impacts resulting from the activity itself as well as the services associated with travel (hotels, restaurants, retail, and transportation). Local residents typically travel shorter distances and therefore generate fewer transportation and no lodging impacts.

Despite some important distinctions between tourism and recreation, the environmental impacts associated solely with an activity are the same regardless of whether the activity participant is a tourist or a local resident. For example, a local visitor to an amusement park will require the same amount of energy to use the rides, consume the same amount of water, and generate the same amount of waste as a tourist. For some activities, local visitors comprise the majority of participants. Since the local participants also cause impacts, including them into the scope of this report generates a more complete picture of the resource use and environmental outputs of the selected leisure activities than if only tourists were considered.

The study considered ten leisure activities: skiing, fishing, hunting, boating, golfing, casino gambling, amusement/theme parks, historic places and museums, conventions and conferences, and waterside recreation (which includes any visits to freshwater or the coast for the primary purpose of being near the water, e.g. for swimming but not including fishing or boating). These activities were selected for this study because data were available and because they were thought to have significant environmental impacts based on the number of participants and the intensity of resource use and pollutant outputs.

Selected indicators were developed to estimate outputs at a national level for each activity. The outputs include water use, energy use, air pollutant emissions [carbon

monoxide (CO), nitrogen oxides (NOx), and hydrocarbons (HC)], greenhouse gas emissions, municipal waste generation, and waste water quality [Biological Oxygen Demand (BOD) and Total Suspended Solids (TSS)]. In addition, an economic indicator was created to capture direct expenditures by activity participants.

It should be noted that only *direct* outputs and resource uses were included in this study. Direct outputs result from the activity itself (e.g., water use for snowmaking) and from the ancillary or supply sectors (e.g., water use in hotels). Indirect outputs, such as the energy used to build the hotel, are not included.

Total vs. Net Impacts

The calculation of environmental impacts in this report represents total emissions or total resource use rather than net emissions or resource use. While there are benefits to an approach which considers net impacts, and quantifying net impacts would provide a good context for the results of this study, there are two principal reasons EPA chose to concentrate on total impacts. First, estimates of total use are most appropriate for establishing a benchmark because they allow us to revisit the calculations over time to chart reductions or increases to resource use or other environmental impacts. If the impacts were reported as net values, it would be more difficult to make comparisons to the benchmark because the environmental impacts of alternative activities, and perhaps the activities themselves, might change over time. Second, estimates of total impacts facilitate regional or place-based analyses. Because some environmental effects depend on the location in which they occur, subtracting water use in one watershed (e.g., the location of home) from a water use in a different watershed (e.g., the location of hotel) would give a misleading picture of the resource use in the region of interest.

Net impacts could be determined by accounting for the fact people consume water and energy, produce waste, and affect the environment when they are at home as well as

when they are participating in a tourism or recreational activity. In some cases, their normal routine may even generate greater impacts. Net impacts could also be determined by calculating resource use per dollar revenue in the tourism industry and comparing that figure to resource use per dollar revenue in a different industry. In this manner, reporting net values would provide a context to help understand the significance of tourism and recreation activity impacts.

Finally, this study was undertaken with the assumption that tourism and recreation activities will continue to be pursued and will continue to contribute significantly to the nation's economy and quality of life. Under this assumption, it is not necessary to discuss alternatives to tourism and recreation activities; instead, it is important to set the stage so that tourism and recreational activities can become more sustainable.

3. BENEFITS OF TOURISM AND RECREATION ACTIVITIES

Although this study focuses primarily on the environmental impacts of selected leisure activities, it is important to consider the environmental impacts in relation to the benefits of these activities. There has been considerable research on the economic benefits of tourism-related activities; however, measures of economic activity may understate the total social benefits of leisure activities. As described in the remainder of this section, the benefits of tourism and recreation activities are realized by individuals and communities. The environment can also benefit where leisure activities support the preservation or restoration of natural ecosystems.

Individual Benefits

Research on the individual benefits of recreational activities typically assesses how much people are paying or would be willing to pay for various recreational services. Given that billions of dollars are spent on leisure activities in the U.S., and the fact that studies often show that people would be willing to pay more than they actually do for certain recreational services, one can deduce that the individual benefits of recreational activities in the U.S. are enormous.

Personal enjoyment is the main reason that most people participate in recreational activities. There are many other individual benefits that can be classified as either physiological or psychological. Some of the physiological benefits of aerobic recreational activities include: improved cardiovascular system, bones, muscle strength, lung capacity and reductions in hypertension.

Some of the psychological benefits of leisure activities, according to the Academy of Leisure Sciences, include: perceived sense of freedom, enhanced self-competence, improved sense of worth, improved leadership skills, better ability to relate to others, enhanced perceived quality of life, and increased learning about history, culture, nature and cities.

Social Benefits

There is some indication that opportunities for recreation produce societal benefits through, for example, reducing substance abuse, crime, and social ills (Academy of Leisure Sciences). Individuals who are mentally and physically healthier tend to be more productive at work and home, and are more likely to be beneficial members of society.

Many recreational activities produce social benefits through education and exposure to different people, ideas, and environments. Similarly, family bonds can be strengthened when members spend leisure time together. Visiting cultural, historical, and heritage sites, and participating in outdoor activities also promotes an enhanced appreciation for and desire to preserve these sites and our natural environment.

Economic Benefits

Tourism and recreation make up a significant and growing portion of U.S. economic activity. According to BEA's Travel and Tourism Satellite Account, the economic effect of tourism (travel, tourism and business) in 1997 was between $393 billion and $462 billion. This estimate significantly understates the economic effect of leisure activities as a whole because it does not include recreation. An estimate of recreational activities spending, also derived from BEA's Travel and Tourism Satellite Accounts, is between $43 billion and $50 billion, bringing the total direct economic value of leisure activities to between $436 billion and $512 billion.

To gain a more complete picture of the economic contribution of tourism and recreation, one can use a multiplier to estimate the indirect effects of dollars spent on tourism. For example, businesses that earn tourism dollars pay taxes, purchase materials and hire employees. Using IMPLAN input-output model, EPA calculated a multiplier of 2.77 for the tourism industry[6].

Using the multiplier, it is estimated that the total economic impact of tourism and recreation in the U.S. is between $1.1 and $1.3 trillion dollars[7] and total employment is between 15.1 and 17.8 million jobs nation-wide.[8] These data represent national aggregates for all types of leisure activities, and thus will not be sufficient to characterize specific types of activities in specific areas. They are useful in larger studies and perhaps for comparative purposes in studies that are limited in region or type of activity.

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[6] Memo from Jared Creason, US EPA, dated December 7, 2000.

[7] The $50 billion estimated as spending by participants in local recreation was not included the calculation of indirect economic activities.

[8] Domestic tourism demand is calculated by subtracting travel by U.S. residents abroad and international air fares from total tourism demand.

Environmental Benefits

The same leisure activities that result in environmental impacts can also benefit the environment by preserving natural resources or instilling an appreciation for the environment. Although difficult to quantify, such benefits are important to consider.

Wetlands Restoration Program - U.S. Fish and Wildlife Service

The Wetlands program automatically transfers federal excise tax dollars on certain motor fuel sales to priority states with high rates of wetlands losses. The program has resulted in surface water quality improvements and fisheries habitat restoration.

Tourism and recreational activities create economic incentives to protect the natural and cultural environment. Tourism and recreation can also provide an alternative to development scenarios that may have greater environmental impacts. Many treasured natural and cultural sites are protected by federal, state, and local governments for the public's leisure and recreational use. Other natural areas of the U.S., which currently are without government protection but are supporting recreational uses, alternatively could be supporting more polluting or resource intensive industries. While the environmental impacts associated with large influxes of people and the necessary supporting infrastructure are important to understand, they should be considered along with the impacts of the potential alternatives to gain a more complete picture. For example, the air, water, waste, and noise pollution associated with a mining operation may be greater than the impact of a resort located in the same place.

Ski Industry Environmental Charter

The National Ski Areas Association (NSAA), in conjunction with environmental groups and government agencies, developed an Environmental Charter in 2000. The charter covers three topics: planning and design, operations, and education and outreach. Within these areas are principles for preventing, reducing and measuring environmental impacts. As of November 2000, roughly 160 ski areas, representing 70 percent of the country's skiing visits, had endorsed the charter and agreed to implement the principles.

Recreational Trails Program
Federal Highway Administration
The FHA collects $50-$150 million each year from taxes on off-highway fuel use in order to assist in constructing and maintaining trails, and mitigate environmental impacts associated with recreational trail activities. The National Scenic Byways Program provides financial, technical, and marketing assistance for corridors of special scenic, recreational, cultural, and historic significance. The program focuses on developing and supporting corridor management plans. The nearly 100 routes designated to date include a large number of routes in environmentally sensitive areas.

As a tourism attraction, certain ecosystems and endangered species can create economic value, and thereby help to ensure their protection. For example, jobs and income are created to support visitors wishing to observe wildlife and habitat. Similarly, user fees, taxes on recreation equipment, and license fees for activities such as hunting and fishing provide governments with resources to manage natural resources.

West Virginia whitewater rafting head tax
A tax is collected from everyone who participates in a commercial rafting trip. The fee goes toward studying the environmental impacts of rafting. In addition, the rafting companies have several river clean-up days.

Through exposure to natural and cultural resources, many tourism and recreational activities promote an environmental appreciation among their participants. This environmental ethic then gets put into practice through the work and leisure activities of people. It has been observed that the rise of widespread tourism in the U.S. in the 1950's and 1960's occurred at the same time as an increase in the awareness of environmental concerns among the American public. An informed and concerned public is a powerful force for protecting natural and cultural sites. Recognizing this, businesses and governments make efforts to educate visitors to natural and cultural attractions.

Marine Sanitation Device Pump-Out Program Grants (U.S. FWS)
This program provides grants to install marine sanitation treatment devices for low or no fee at marinas and refueling stations. These additional devices allow boaters to empty their tanks in some of the places where the wait had been too long or there had been a significant fee. The program is paid for with federal excise taxes on fishing gear or fuel, and has increased compliance with sanitary discharge regulations

For example, the National Park Service educates visitors on the characteristics of park ecosystems, demonstrates the manufacturing of recycled and sustainable goods, and provides information on the resource use in park facilities.

Amelia Island Plantation
Florida

The Amelia Island Plantation established setbacks from wetlands and dunes 10-20 years before such setbacks became law throughout the state of Florida. Its developers recognized that protecting the fragile ecosystem was an investment and not a cost, and that this investment would pay dividends in a quality of life not found at other resorts. AIP has realized long-term benefits of set-asides, setbacks and tree/vegetation protection. Property values have increased and property owners are more satisfied from an enhanced quality of life. Visitors to AIP participating in passive recreation such as hiking, canoeing/kayaking, fishing and bird watching in and around the wetlands of Amelia Island Plantation personally interact with the environment. That personal interaction is the first step toward instilling a sense of

Other benefits - environmental, economic and social - may stem from tourism and recreation industries. Future work could seek to quantify these benefits to provide a more complete picture of the impacts of leisure activities.

Sleeping Lady Conference Retreat, Leavenworth Washington
Conservation Methods at Sleeping Lady

Electrical energy is used at Sleeping Lady, except for propane used in the kitchen and solar panels used to warm a small pool. Solar and wind power are not practical at this location, so efforts are focused on conservation and waste reduction. The Heat Recovery System extracts waste heat in the kitchen and laundry and transfers it to heat water efficiently and economically while cooling and dehumidifying hot spots above the oven, dishwasher, and dryer. The Energy Management System is computerized and allows an attendant to control heating for the whole site. Unoccupied rooms are not heated. To conserve water and energy for laundry, bed linens are changed every four days. Compact Fluorescent Lights are used extensively throughout the site. Building Insulation is made from ground computer paper and cardboard boxes and blown into the walls with a water-based, fire retardant binder that is non-toxic. Energy-Efficient window panes are not made from old growth wood. There is an Air-To-Air Heat Exchanger that exchanges warm indoor air with cold outdoor air while capturing and reusing some of the indoor heat. Floors are mostly wood: either new maple or fir, or recycled fir flooring. The bathroom floors are made of a composition of linseed and plant fibers. Decking around the buildings is made from plastic grocery bags and hardwood chips. Native Plants, except vegetables and fruits, have been used for all landscaping. Kitchen Waste is all used on site. All organic waste is composted.

4. ENVIRONMENTAL IMPACTS

Tourism and recreation are inherently linked to the well-being of the natural environment. Loss of the attributes that make a site or region attractive to tourists and recreationists can economically compromise the tourism and recreation industries in that region and detract from the livelihoods of people who depend upon them. Businesses that supply tourism and recreation goods and services, governments at all levels, and the tourists and recreationists themselves share a stake in ensuring the long-term sustainability of recreation and tourism resources.

Sustainable development has been defined as "development which meets the requirements of the present generation without endangering the requirements of future generations." The Environment Summit in Rio de Janeiro in 1992 helped elevate the concept of sustainable development to a global priority. As discussed in a recent report published by the German Federal Agency for Nature Conservation, sustainability, with respect to tourism development, means:

- ensuring environmental quality, so that even when tourism grows in volume, the stress on soil, water, air/climate and site coverage decreases;
- preservation of biological diversity and responsible management of the specific uniqueness and beauty of nature and landscape, for nature and landscape are a non-increaseable and non-replenishable resource;

- decrease of resource consumption and increase of efficiency in using natural and cultural resources, so that tourism can remain profitable and economically healthy in the long run.

With improved information and careful management and planning, tourism and recreation activities can provide economic benefits to communities in ways that do not degrade the environment. Sustainable tourism and recreation industries can be seen as protectors of the environment by discouraging less sustainable industries. Sound management can increase the number of tourists and recreationists that can sustainably use a site. Likewise, neglect and mismanagement can result in unsustainable impacts from a relatively small number of people.

Visitors inevitably increase consumption of resources and energy and waste production at a site. The effect of this on the health of the ecosystem will depend on the intensity of use, other pre-existing or concurrent problems (e.g., acid rain or climate change), the ecosystem's carrying capacity (its ability to withstand impacts), and the community's infrastructure capacity. Environmental impacts are not confined to the site of the activity. For example, some of the largest impacts of tourism on the environment arise from individuals traveling to the tourism destination. Other suppliers of goods and services to tourists and recreationists may impact other ecosystems and may contribute to the overall depletion of natural resources.

Tourism and recreation development in many cases may be environmentally preferable to alternative types of development. Many rural communities benefit from preserving their natural resources for recreational purposes, attracting new visitors and residents, new businesses and economic growth in a manner that is more sustainable than the alternative extractive industries. Some urban areas have undertaken efforts to promote tourism in place of the more traditional heavy industrial activities commonly located near urban areas. In addition to economic benefits, these communities have benefitted economically from cleaner air and water, more open spaces, and more

recreational and cultural opportunities. Similarly, some types of tourism and recreation can be more sustainable than others. Ecotourism is being promoted by many communities as a sustainable alternative to more intensive tourism and recreation such as large scale resort development.

The environmental impacts of tourism and recreation activities vary significantly among subsectors of the industry. In some cases, the recreation activity itself will be a major component of sector environmental impacts (e.g., off-road driving). In other cases, the activity itself has little environmental effects (e.g., bird watching) and the major impacts result almost entirely from travel to the destination and other associated activities. In addition, the potential for environmental impacts for a given activity will vary depending on the vulnerability of the affected environment.

Environmental Indicators

In recent years there has been considerable interest and concern about the combined economic, social and environmental sustainability of development. Industry and governments are increasingly looking to integrate environmental concerns into economic decisions and vice versa. To do so requires a means of measuring and monitoring environmental impacts. Given that the tourism and recreation industry's economic well-being and environmental quality generally enjoy a mutually supportive or symbiotic relationship, stakeholders in this industry have been leaders in developing methods for quantifying environmental impacts.

The types of environmental impacts vary considerably depending on the specific activity. In addition, while some environmental impacts are tangible (e.g., concentration of pollutants in the air), many are less tangible and more difficult to quantify (e.g., strain on an ecosystem). These complications make it a challenge to measure environmental impacts.

Environmental indicators can be used as an effective way to quantify, monitor and communicate environmental impacts. An indicator is "a measure that provides a clue to a matter of larger significance or makes perceptible a trend or phenomenon that is not immediately detectable" (World Resources Institute, 1995). Indicators are used extensively to track trends and guide decision-making processes in many fields. Examples of common economic and social indicators include the Gross Domestic Product and literacy rate, respectively. Indicators quantify and simplify information on complex phenomena so that it is more readily analyzed and communicated.

Indicators of environmental performance or sustainability are gaining widespread use. The World Resources Institute, the Organization of Economic Cooperation and Development (OECD), the U.S. Interagency Working Group on Sustainable Development, the President's Council on Sustainable Development, and the United Nations Commission on Sustainable Development are just a few of the organizations that have recently been involved with developing environmental sustainability indicators. The Environmental Committee of the World Tourism Organization has developed a set of environmental indicators specifically for the tourism sector. Most environmental and socio-economic indicators of sustainable development can be distilled into four categories: 1) resource depletion; 2) pollution; 3) ecosystem risk; and 4) impact on human welfare.

This existing work on environmental indicators provides a useful slate of measures to consider in developing this model of environmental indicators for tourism and recreation.

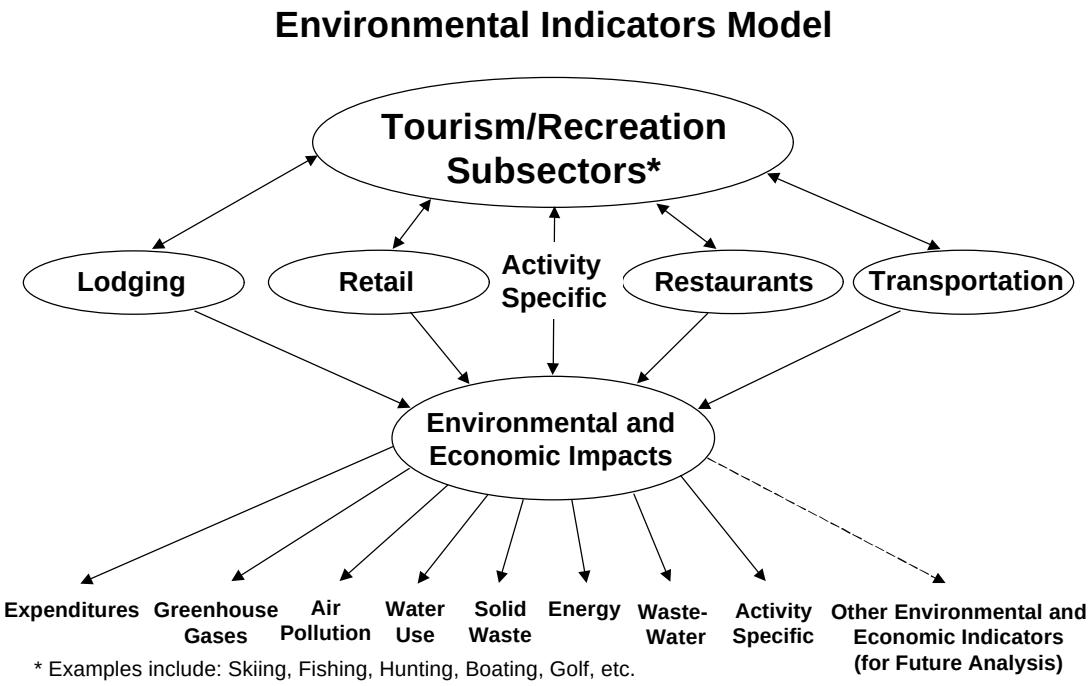
5. AN ACTIVITY-BASED METHODOLOGY

EPA's model generates economic and environmental indicators specific to subsectors of the tourism and recreation industries. These indicators, alone and in combination with other subsector-specific data such as participation rates, and person-days of participation, provide measures to chart progress toward more sustainable tourism and recreation.

Tourism and Recreation Subsectors

Subsectors are defined by leisure activity. The activities or subsectors included in this study are: skiing and snowboarding, fishing, hunting, boating, golf, casino gambling, amusement/theme parks, historic places and museums, conventions and conferences, and waterside recreation (which include any visits to freshwater or the coast for the primary purpose of being near the water and not including fishing or boating). These activities were chosen because they may have significant economic or environmental impacts and because there are reliable data on participation, related businesses and facilities, economic expenditures and associated resource use of the activities themselves. These subsectors could be augmented with other subsectors of interest

such as: all terrain vehicle (ATV) use, snowmobiling, cruises, arena/stadium events, camping/hiking, and many more.



Two types of economic and environmental indicators are measured for each activity: those for recreational activities themselves, and those for supporting activities, e.g., traveling to the destination, food and lodging, that are undertaken in direct support of the recreational activity. The impacts associated with the activities themselves include those arising from all participants, regardless of the distance traveled to get to the site.

Only the direct economic and environmental impacts are calculated in the model. That is, the model includes those supply sectors that deal directly with tourists and recreationists. Direct businesses and services include hotels, restaurants, and airlines,

while indirect businesses and services might include laundry services, equipment manufacturers, travel publications, restaurant suppliers, real estate developers, and banks. For example, indicators of the environmental and economic impacts of airline travel are assessed using this model, but indicators of impacts associated with manufacturing the aircraft are not. Indirect environmental impacts, while potentially important contributors to an industry's overall impacts, are often more difficult to quantify and attribute to a specific industry.

This model differs from earlier models of tourism and recreation. Most are designed to measure and forecast the economic impacts of tourism as a whole, either at a national or regional level, or to assess site-specific impacts of individual tourism and recreation activities. These models do not examine environmental impacts on a national scale for specific activities.

This model captures the diversity of the tourism and recreation sector, allowing a better understanding of its many segments. A more aggregated approach would place attention either on a few large sources of environmental impacts that are common to all tourism (e.g., transportation) but miss individual subsectors' unique economic and environmental impacts, as well as factors that influence environmental protection decisions in particular segments of these industries.

Economic and Environmental Indicators

In its current state, the model uses a single economic indicator of expenditures on tourism and recreation. The model uses nine environmental indicators: water use, wastewater [Biological Oxygen Demand (BOD) and Total Suspended Solids (TSS)], energy use, air pollutant emissions [carbon monoxide (CO), nitrogen oxides (NOx), and hydrocarbons (HC)], greenhouse gas emissions (CO_2 equivalents), and municipal solid waste generation. The indicators presently included in the model were selected for two primary reasons: 1) data for each are frequently collected by both government

and industry, and 2) they can be quantified for each subsector (i.e., they are not subsector specific) allowing for comparisons between subsectors. Any indicator that fits these criteria could be added to the model. Other economic indicators that could expand the model include employment, wages, and tax revenues. Future expansion of environmental indicators could include renewable energy use, other toxic and criteria air emissions, waste recycling, and toxic wastewater pollutants.

The indicators focus on the total impacts of subsectors, rather than on the net impacts of participants. Total impacts are relevant for communities, policymakers, and tourism managers who seek to identify and mitigate impacts on particular tourism and recreation sites or regions. For groups interested in net impacts, such as communities weighing tourism and recreation against a different economic development scenario, or tourism and recreation participants who are concerned about their impacts relative to their everyday impacts at home, it would be necessary to calculate the indicators for the alternate activity and subtract those values from the ones reported in this document.

Brief discussions of each indicator, the industry supply sectors that are currently accounted for in the model, and how these indicators actually relate to environment and human health concerns are provided below. Appendix A provides a detailed description of the inputs used for specific subsectors and the data limitations.

> **Water use:** The water use indicator in this model accounts for gallons of water used in lodging, restaurants, retail, and the recreational activities. Fresh water is essential for household, agriculture, industrial and commercial purposes. It is also a critical habitat for many plant and animal species. Water taken from an ecosystem for human use can temporarily or permanently affect the recharging needs of wet and wetland habitats and the essential physical functions of the water cycle, such as the cleansing action of flood waters.

Wastewater pollutants: Wastewater pollutant indicators in this model were developed for lodging, restaurants, retail and specific sectors (where data were available). Two measures of water pollution are included: Biological Oxygen Demand (BOD) and Total Suspended Solids (TSS). BOD is an indication of the amount of organic matter in water that is released to the environment. Because microbes consume oxygen when they break down organic matter, less oxygen is available in polluted water for fish and other aquatic life. At very low oxygen concentrations, advanced aquatic life ceases. Total Suspended Solids (TSS) impact an aquatic environment in several ways. They reduce light penetration, which affects algae and plants that depend on photosynthesis. Solids can clog fish gills, which either kills the fish or reduces their growth rate. When solids settle out, they cover the bottom of the waterbody and can bury eggs and degrade the habitat of bottom-dwelling organisms.

Energy use: The energy use indicator is measured in British Thermal Units (Btus) and accounts for electricity and fuel use associated with lodging, restaurants, retail, transportation, and recreational activities. Fuel use comes not only from transportation, but also from furnaces and boilers used in hotels, restaurants, and retail for heating and cooking. Units of fuel and electricity consumption are translated into Btu's for comparison purposes. Btu values are not calculated to account for secondary fuel use, that is, fuel use at electric power generation plants.

Air pollutant emissions: Air emission indicators in the model account for direct air emissions from transportation, restaurants, retail and recreational activities. These values do not include the generation of electricity as a source. The air emissions indicators include carbon monoxide (CO), nitrogen oxides (NO_x), and hydrocarbons (HC). These indicator pollutants have the potential for direct impacts on human health, vegetation and materials damage. Carbon monoxide is a poisonous inhalant that deprives the body tissues of necessary

oxygen. Nitrogen oxides and hydrocarbons can have adverse effects on humans when inhaled above certain concentrations. Environmental impacts also arise when these pollutants are present together in the atmosphere, where they react in the presence of sunlight to form photochemical smog, or ozone. Photochemical smog is damaging to plants, reduces visibility, can be detrimental to human health, and can degrade the overall experience of leisure activity participants.

Greenhouse gas emissions: Greenhouse gas emissions are calculated for lodging, restaurants, retail, transportation, and recreational activities. Emissions from these categories are primarily due to the combustion of fossil fuels and include emissions from electric power generation.[9] The major greenhouse gases are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Emissions of these three gases are converted to a single measure through established factors, and are reported in this report as CO_2 equivalents. Though greenhouse gas emissions are generated during fossil fuel combustion like other air pollutants such as CO, NOx, and HC, they are presented separately because the type and scale of their effects are quite different. Greenhouse gases trap heat in the atmosphere, so that an overabundance of these gases increases temperatures worldwide. This temperature increase in turn causes shifts in climate patterns that lead to droughts, floods, eroded agricultural soil, and disrupted ecological habitats. Also, due to the increased temperature of oceans and the melting of polar icecaps, sea levels rise.

Municipal solid waste generation: The waste generation indicator takes into account tons of municipal waste generation associated with travel, lodging, restaurants, retail facilities and specific recreational activities. The effects of municipal wastes on the environment are varied. First, municipal wastes are

[9]Unlike the indicators that include only direct impacts, the greenhouse gas indicator captures the impacts associated with electric power generation which is otherwise considered an indirect impact.

comprised of wasted raw materials and natural resources. Improperly managed municipal wastes in the environment can spread infectious disease and be toxic to human health and the environment. The management of municipal wastes can also have adverse impacts on the environment. The collection, processing, and recycling of wastes are all energy intensive and costly. Landfilling and incineration both result in residual releases to the environment.

Model Inputs and Outputs

The model requires various activity-specific trip data and activity-specific environmental data as inputs. The trip-related data inputs (e.g., annual number of participants, trips of any length or duration, miles, days, overnights, and expenditures) are primarily obtained from industry surveys specific to each activity subsector. Such survey data may not be in the exact form required by the model or may not encompass all of the required information. Therefore, the actual model inputs are often derived from two or more separate sources, and occasionally from assumptions based on travel and expenditure patterns in the U.S. Activity-specific environmental data are obtained from a variety of sources, including industry surveys (e.g., water used by golf courses), engineering texts (e.g., typical water usage in waterside recreational areas), and government studies (e.g., electric power usage by conference and convention centers).

In addition to the sector-specific input data, there is also a significant amount of environmental indicator data not specific to the activity subsectors embedded within the model. Examples include: average water and electric power use per hotel guest, air emissions per mile of automobile travel, and average waste generation per restaurant meal. These data are constants and are the same for all subsectors.

The model uses the input data to identify the relationships between tourism and recreation activities and sustainable development. Theoretically, the model can output hundreds of different combinations of the input data. However, only a portion of these combinations are useful in gaining a better understanding of sustainability issues. A comprehensive list of the model input requirements and output measures are summarized in the tables below. The indicators measure either emissions or resource use. In order to understand the sustainability issues surrounding these results, one must consider the effect of the activities on a specific ecosystem or community. There is substantial variability in the capacity of ecosystems to withstand environmental stresses such as the withdraw of freshwater or increased air pollutant emissions. Linking these stresses to actual environmental effects requires additional data and analysis at a local level. This would be a valuable next step for readers who wish to understand the sustainability of leisure activities.

Tourism and Recreation Model Environmental Inputs

	Lodging	Restaurant	Retail	Transporta-tion	Activity-Specific
Water use	X	X	X		(X)
BOD	X	X	X		(X)
TSS	X	X	X		(X)
Electric energy use	X	X	X		(X)
CO	X	X	X	X	(X)
NO_x	X	X	X	X	(X)
HC	X	X	X	X	(X)
CO_2 equivalents	X	X	X	X	(X)
CH_4	X	X	X	X	(X)
N_2O	X	X	X	X	(X)
Waste Generation	X	X	X		(X)

(X): When applicable

BOD: Biological Oxygen Demand, TSS: Total Suspended Solids, CO: carbon monoxide, NO_x: nitrogen oxides, HC: hydrocarbons, CO_2: carbon dioxide, CH_4: methane, N_2O: nitrous oxide

Tourism and Recreation Model Subsector Inputs

General	number of participants
	number of trips
	number of person-days
Lodging-related	number of overnight stays
	number of lodging days
	number of checkout days
	lodging expenditures
Restaurant-related	number of meals
	restaurant expenditures
Retail-related	retail expenditures
Travel-related	person miles – auto
	person miles – air
Activity-specific environmental inputs	water use
	wastewater generation
	electric energy
	air emissions
	greenhouse gas emissions
	waste generation

Outputs for Each Activity Subsector

	Per Participant	Per $ Expenditure	Per Person-Day	Per Trip	Lodging	Restaurants	Retail
Water Use	X	X	X	X	X	X	X
BOD Generation	X	X	X	X	X	X	X
TSS Generation	X	X	X	X	X	X	X
Electricity Use	X	X	X	X	X	X	X
CO Emissions	X	X	X	X	X	X	X
NO_x Emissions	X	X	X	X	X	X	X
HC Emissions	X	X	X	X	X	X	X
Greenhouse Gas Emissions	X	X	X	X	X	X	X
Waste Generation	X	X	X	X	X	X	X
Miles Traveled	X			X			
Lodging Days	X			X			
Expenditures	X		X	X			

BOD: Biological Oxygen Demand, TSS: Total Suspended Solids, CO: carbon monoxide, NO_x: nitrogen oxides, HC: hydrocarbons

Industry-Wide Outputs

Water Use
Wastewater BOD Generation
Wastewater TSS Generation
Energy Use
CO Emissions to Air
NOx Emissions to Air
HC Emissions to Air
Greenhouse Gas Emissions to Air
Municipal Waste Generation

BOD: Biological Oxygen Demand

TSS: Total Suspended Solids

CO: carbon monoxide

NO_x: nitrogen oxides

HC: hydrocarbons

Calculation Methods

There are two methods used to calculate the indicators, depending on the available data. Appendix A provides more detail on the two methods. Most indicators for the different recreation activities and sectors were determined by a calculation of the form:

$$P * R = E$$

Where P represents the participation (e.g., visitors, hotel nights, etc.), R is an emissions factor that has been converted to quantity per unit of participation, and E represents the total value of the indicator for the particular subsector (e.g., annual NOx emissions by the boating subsector).

For a limited number of activity/sector combinations, the indicators were estimated with an alternative method:

$$X * M = E$$

Where X represents expenditures in an activity and M is an emissions factor expressed in terms of quantity per dollar spent on the activity. Indicators calculated with this method include those for fishing, hunting, boating, and conferences and conventions, as well as indicators associated with the retail supply sector.

Limitations

When interpreting the outputs of this model, it is important to keep in mind the objectives of the modeling approach and its limitations. This methodology may be used to compare environmental performance among activity-based subsectors of the industry. Such comparisons can be used to identify and prioritize individual subsectors (e.g., skiing, golf) or certain aspects of subsectors (e.g., travel, lodging, or the recreational activities themselves) that could be the focus of initiatives to improve environmental performance. This study also provides a baseline measure of environmental performance of some of the industry's subsectors. Trends over time can then be tracked against this baseline.

The indicator values are estimated from a number of data sources. The quality of these sources can vary widely. Occasionally data are not available or are incomplete, requiring that certain effects be left out or estimated. In some cases, environmental indicator data from a single recreational facility is extrapolated to the entire activity subsector in the U.S. Furthermore, all possible contributors to an economic or environmental indicator may not be considered.

Initial efforts have been focused on obtaining and incorporating the largest contributors to a resource consumption or waste issue, occasionally at the expense of relatively small contributors. For example, in quantifying water use by the golfing

subsector, considerable efforts were made to establish accurate values for irrigation water use, which is a relatively large source of water use for this subsector. Water use for sanitary purposes was not factored into the indicator because of the lack of available data. Including these data in future water use estimates for golf courses will provide a more complete picture of golf course water use.

The participation rates for each activity may be underestimated as well; all of the surveys, except that used for the Amusement/Theme Park subsector, were based on telephone or mail surveys of American households. As a result, the participation rates reported for most subsectors do not include international travelers to the U.S. It is estimated, however, that only 4% of trips in the U.S. greater than 100 miles are due to international travelers; but at the same time trips over 100 miles only make up a portion of the participants we are studying. Given the overall degree of accuracy of this study in its current form, this omission is not expected to be a significant limitation.

In addition, simplifications were made for some subsectors and producer industries. For example, the role of second homes and families' and friends' homes were not considered. Instead, travelers to second homes were considered, for the purposes of the indicators, to stay in hotels or motels. This simplification overestimates lodging expenditures and may affect other indicators. Second homes also may have impacts in areas not considered in this study, including land use and property tax revenues.

It is important to note also that, at this stage, not all of the environmental indicators are considered for all of the supply sectors. While water use, electric energy use and waste generation are estimated for the lodging, restaurant and retail supply sectors and for the activities themselves, they are not yet estimated for the transportation supply sector. As noted earlier, the indicators only address the direct impacts of each activity. The impacts of related infrastructure and development, such as new housing and roads

that often come hand-in-hand with tourism and recreation attractions, are not examined.

Another important limitation of this study is that it addresses environmental impacts on a national level. The indicators provide a broad perspective and do not distinguish variations in season or actual environmental stress that depend on the location of the activity. For example, air emissions of NOx from cars and airplanes are treated equally, despite the fact that NOx emitted from aircraft above 10,000 feet may have up to 50 times the greenhouse gas effect of NOx emitted closer to the ground. Similarly, water use for snowmaking in the mountains is treated the same in this model as water use for golf courses in the desert. The environmental stress from water consumption is likely to differ in each of these situations. The model also does not distinguish between total water use, some of which returns to the source following snowmaking or irrigation, and consumptive water use.

Finally, when interpreting the model results, it is important to understand that there may be some overlap between the economic and environmental indicator values attributed to each subsector. Efforts were made to minimize overlap between activity subsectors, but tourists and recreationists often participate in multiple activities and occasionally it is difficult to say where one activity ends and another begins. An example is the potential overlap between the fishing and boating activity subsectors. The data assembled on the boating subsector were in part collected from a survey of individuals who stated that their primary trip activity had been boating. Nevertheless, a portion of their time may have been spent fishing. Therefore the model may be attributing some fishing travel and visiting impacts to the boating subsector. The data assembled on the fishing subsector covered individuals whose primary trip activity had been fishing. Again, a portion of the impacts that can be associated with boating may have been attributed to the fishing activity subsector.

Directions for Future Work

The model described in this report is a work in progress. It offers a flexible, analytical tool to better understand the environmental impacts of leisure activities. The model was designed to grow as additional data become available and as new applications for it arise. With additional research to refine input data, any activity subsector can be examined in greater detail. The model also could be configured for interactive access through additional formats, such as the World Wide Web.

In addition to continually improving the existing subsector specific data inputs, we have identified a number of promising areas for future work.

Incorporate additional subsectors.

The ten activities presently included comprise a large portion of the tourism and recreation industry's economic and environmental impacts. Still other activities potentially having significant impacts are not yet included. We designed the model to make it possible to add new subsectors. Additional activity subsectors that could be included are: snowmobiling, all terrain vehicle (ATV) use, recreational vehicle (RV) use, hiking and camping, and cruises.

Incorporate additional economic and environmental indicators.

Currently the model provides a set of important indicators for examining and comparing the economic and environmental impacts of selected leisure activities. Additional indicators, both economic and environmental, could make the model a more useful tool. Key economic indicators for consideration include employment and tax revenues. Suggested additional environmental indicators include water use in arid regions versus water use in temperate regions, toxic pollutants in wastewater discharges, air toxics, and species endangerment. In addition, since tourism, travel, and recreation activities can have positive environmental effects, indicators such as habitat preservation and watershed protection may also be added.

Incorporate indirect economic and environmental impacts.

The model looks only at direct economic and environmental impacts. Indirect impacts are those associated with products and services that are not provided directly to tourism and recreation participation. For example, air pollutant emissions associated with the generation of electricity used by tourism and recreation businesses are not currently considered in the model. Nor is the economic impact associated with expenditures on this electricity included. Such indirect impacts, while likely to be significant, were beyond the scope of the study, which is limited to those economic and environmental impacts that are directly affected by industries in the tourism and recreation subsectors. Furthermore, a more advanced model and additional data would be required to capture the indirect effects.

Incorporate time trends for forecasting.

Addition of time trends to the model would allow its use as a forecasting tool. The economic impacts, environmental impacts, and resource use associated with each subsector may change over time. Activity participation rates and the number and distribution of facilities also vary with time. Tourism and recreation activities that have relatively little impact today could have significant impacts in the future, and other activities could decline in importance. The model could be expanded to include trends data as inputs and then output measures could be estimated for future dates.

Net effects.

The calculation of net effects would provide a context to understand the environmental impacts of leisure activities relative to other activities (e.g., going to work, gardening) or industry sectors such as agriculture, mining or manufacturing. However, accounting for all of the different variables that would determine the positive or negative net effect of engaging in these leisure activities (versus staying at home and commuting to work) would be difficult. Future work on this would require additional collection of more recent data, then analysis to account for the “substitute effects” generated by participating in leisure activities.

6. RESULTS

This section demonstrates the application of the model by presenting comparisons of selected indicators and measures across activity subsectors. Results for the skiing, fishing, hunting, boating, golf, casino gaming, amusement/theme parks, historic/cultural attractions, conventions and conferences, and waterside recreation subsectors are presented in Tables 1 and 2, and Figures 1 through 17 below.

As discussed in the previous section there are several limitations which should be kept in mind when reviewing the results of this study. The reader should refer to that discussion to assist with appropriate interpretation of the results.

Table 1 presents for each of the ten activity subsectors a few key data inputs that often have an important influence on the resulting environmental indicators for the subsectors. These key inputs include: number of participants, expenditures, lodging days, travel miles by mode of travel, and activity-specific indicators. Table 2 presents some of the key indicator outputs for each activity subsector. Key outputs include water use, wastewater, energy use, municipal waste, air emissions, and greenhouse gases.

For each environmental indicator the results are presented such that comparisons can be made among the activity subsectors. One graph for each indicator presents the

total consumption/generation for each subsector. A separate graph indicates the same quantities per 1,000 dollars of expenditures, per trip, and per participant. A few observations for each environmental indicator are presented below.

Water use

Because hotels and motels use large quantities of water, the total water used by an activity subsector will primarily be a factor of days of overnight lodging associated with the subsector. The exception is when there is significant water use associated with the recreational activity. The conferences and conventions subsector illustrates the influence of lodging days on water use. Table 1 shows that there is a relatively large number of lodging days and few trips associated with conference and convention participants compared to the other sectors studied. This results in very high water use per participant and trip as seen in Figure 2.

Other subsectors, such as museums and historical places, and waterside activities have a relatively high total water use due to their relatively high number of lodging days and participation rates. However, when presented as a ratio of expenditures, trips, or participants as in Figure 2, the values are similar to the other sectors. Waterside recreation has a high water use by expenditure due to the relatively low total expenditures for this activity.

Wastewater

BOD and TSS generation differ somewhat in their primary sources. For most subsectors, restaurants are the source for the majority of BOD. This is because of the high concentration of fats, oils and grease that are released to wastewater during cooking and clean-up. With regard to TSS, however, most can be attributed to hotels. This may be because of the high water consumption at hotels. The results indicate that among the subsectors on a per-participant and per-dollar expenditure basis, waterside had the highest BOD and TSS release rates. Conventions had the highest BOD and

TSS release rates on a per-trip basis because of the higher percentage of participants who stay in hotels.

Energy Use

Total energy use for each subsector is primarily a factor of overall participation and lodging days. Two of the subsectors that consume the most energy are waterside activities and museums and historical places (Figure 8). Because Figure 9 shows that the energy use is about average by trip and participant for these two subsectors, we can conclude that the high participation rates are driving the large total energy use. Another energy-intensive sector is conferences and conventions; this is primarily due to the large portion of participants using hotel lodging. Figure 10 indicates that waterside activities are the largest consumer of energy for transportation, which is driven by the high participation rate.

Air Emissions

Air emissions in the tourism and recreation industry are primarily driven by distances traveled by automobile to the activity site and by the activities themselves. For the subsectors studied, the boating and waterside recreation subsectors account for much of the air emissions. In the case of boating, the higher emissions can be attributed to the use of boat and jet ski engines, which tend to have significantly lower efficiencies and emission controls than automobile engines, resulting in high HC, CO, and NOx emissions. The relatively high air emissions for waterside recreation can be attributed to the large distances traveled by the many participants and frequent trips in this subsector.

Greenhouse Gas Emissions

Greenhouse gas emissions are dependent on transportation and, to a lesser extent, lodging. Transportation accounts for between 40 and 90 percent of greenhouse gas

emissions. Emissions per participant are highest for waterside activities, because of the high number of trips per person. Per trip emissions are highest for convention participants because many of these trips involve long-distance flights.

Municipal Solid Waste Generation

Municipal solid waste generation is primarily dependent on the number of restaurant meals. Figure 11 shows that of the subsectors studied, the waterside activity subsector generates by far the largest quantities of municipal solid waste. An examination of Figure 12 also shows a relatively high rate of waste generation per participant. Table 1 shows that the subsector also accounts for the largest number of meals and that activity-specific waste generation has been attributed to the subsector. In addition, waterside recreation is associated with frequent overnight trips resulting in a relatively high number of lodging checkout days. Estimates for waste generation during checkout days are considerably higher than normal lodging days. (Rhyner, Shwartz et. al., 1995) All of these factors contribute to the large waste generation rate for the waterside recreation.

Table 1: Key Data Inputs by Activity Subsector

Variable	Skiing	Golf	Fishing	Hunting	Boating	Waterside	Conventions	Amusement	Historical	Casino
Participants	9,500,000	23,000,000	35,000,000	14,000,000	36,000,000	132,000,000	26,000,000	54,000,000	54,000,000	60,000,000
Total Trips[1]	27,000,000	280,000,000	510,000,000	220,000,000	290,000,000	978,000,000	43,000,000	260,000,000	240,000,000	180,000,000
Total Days	53,000,000	530,000,000	630,000,000	260,000,000	530,000,000	1,900,000,000	120,000,000	260,000,000	450,000,000	270,000,000
Avg. Length of Overnight Stay	4.7	4.9	3.0	3.0	4.7	6.2	3.0	n/a	4.3	3.70
Total Lodging Days	21,000,000	140,000,000	25,000,000	6,300,000	126,000,000	630,000,000	90,000,000	97,000,000	220,000,000	95,000,000
---Regular Days	16,000,000	120,000,000	16,000,000	4,200,000	100,000,000	530,000,000	60,000,000	90,000,000	170,000,000	69,000,000
---Checkout Days	4,400,000	30,000,000	8,400,000	2,100,000	27,000,000	100,000,000	30,000,000	6,900,000	50,000,000	26,000,000
Total Meals	140,000,000[3]	860,000,000[3]	1,300,000,000[3]	520,000,000[3]	830,000,000[3]	4,900,000,000[3]	470,000,000[3]	620,000,000[3]	690,000,000[3]	530,000,000[3]
Total Expenditures (millions)	$ 9,900	$21,000	$25,000	$16,000	$16,000	$46,000[3]	$17,000	$34,000	$62,000	$100,000
Total auto-miles(millions)	2,600	4,300	40,000	18,000	18,000	170,000	3,700	13,000	7,100	44,000[3]
Total person air-miles (millions)	9,200[3]	6,400	10,000	4,300	10,000	95,000	24,000	46,000	39,000	19,000
Activity Specific Water Use (million gallons)	50,000[2]	3,500	n/a	n/a	2,200	n/a	350	2,100	1,800	800[3]
Activity Specific BOD (tons)	n/a	n/a	n/a	n/a	240	n/a	n/a	n/a	n/a	n/a
Activity Specific TSS (tons)	n/a	n/a	n/a	n/a	195	n/a	n/a	n/a	n/a	n/a
Activity Specific Energy Use (billion Btu)	5,600[2]	n/a	n/a	n/a	n/a	n/a	1,900	9,900[3]	n/a	400[3]
Activity Specific Solid Waste Generation (lbs)	150,000,000	n/a	n/a	n/a	350,000,000	75,000,000	2,400,000[3]	640,000,000[3]	9,000,000	n/a
Total Activity Specific Air Emissions (tons)										
---HC	18	4,900	n/a	n/a	610,000	n/a	n/a	n/a	n/a	n/a
---CO	55	260,000	n/a	n/a	2,300,000	n/a	n/a	n/a	n/a	n/a
---NOx	218	1,700	n/a	n/a	46,000	n/a	n/a	n/a	n/a	n/a
---Greenhouse Gases (tons CO_2 Equivalent)	760,000	n/a	n/a	n/a	13,000,000	n/a	n/a	n/a	n/a	n/a

Results are based on the methodology and limitations described in this report.

BOD: Biological Oxygen Demand, TSS: Total Suspended Solids, CO: carbon monoxide, NO_x: nitrogen oxides, HC: hydrocarbons, CO_2: carbon dioxide

[1] "Trips" refers to any trip regardless of distance (including excursions less than 50 miles each way).

[2] See Appendix A: Methodology for the derivation of snowmaking resource consumption.

[3] Not based on statistically significant survey data.

Table 2: Key Outputs By Subsector

	Tourism & Recreation Total	Skiing	Golfing	Fishing	Hunting	Boating	Waterside	Conventions	Amusement Parks	Museums/ Historical	Casino Gaming	Total for Subsectors
Participation												
Participants		9,500,000	23,000,000	35,000,000	14,000,000	36,000,000	130,000,000	26,000,000	54,000,000	54,000,000	60,000,000	440,000,000
Total Number of Trips[1]		27,000,000	280,000,000	510,000,000	220,000,000	290,000,000	980,000,000	43,000,000	260,000,000	240,000,000	180,000,000	3,000,000,000
Expenditures (millions $)	*T&R Satellite Accounts*											
Total Expenditures	452,500	9,900	21,000	25,000	16,000	16,000	46,000	17,000	34,000	62,000	100,000	350,000
Lodging Expenditures	63,366	750	4,200	1,700	430	2,700	16,000	8,000	3,500	6,000	3,400	46,000
Restaurant Expenditures	65,502	320	5,200	4,300	2,100	5,000	29,000	4,200	3,700	4,200	3,200	61,000
Retail Expenditures	53,136	1,900	5,100	7,500	6,500	8,100	1,300 **	1,700	-	-	-	32,000
Water Use (million gallons/year)												
Lodging	150,000	2,400	17,000	4,200	1,100	6,500	38,000	19,000	11,000	25,000	11,100	140,000
Restaurant	33,000	410	2,600	2,100	1,000	2,500	14,000	2,100	1,900	2,100	1,600	31,000
Retail	6,500	230	620	920	790	990	160	210	-	-	-	3,900
Activity Specific	59,000	50,000 *	3,500	-	-	2,200	-	360	2,100	1,800	800	59,000
Total Water Use	**250,000**	**52,000**	**24,000**	**7,300**	**2,900**	**12,000**	**53,000**	**22,000**	**15,000**	**29,000**	**13,500**	**230,000**
Wastewater (tons/year)												
BOD												
Lodging	15,000	200	1,400	420	110	650	3,800	2,000	1,000	2,100	1,000	13,000
Restaurant	21,000	270	1,700	1,400	680	1,600	9,400	1,400	1,200	1,400	1,000	20,000
Retail	340	12	32	48	41	51	8	11	-	-	-	200
Activity Specific	240	-	-	-	-	240	-	-	-	-	-	
Total BOD	**37,000**	**480**	**3,100**	**1,900**	**820**	**2,500**	**13,000**	**3,400**	**2,200**	**3,500**	**2,000**	**33,000**
TSS												
Lodging	8,700	120	800	240	60	370	2,200	1,100	530	1,200	520	7,100
Restaurant	3,600	45	280	230	110	270	1,600	230	210	230	180	3,400
Retail	270	10	26	39	33	42	7	9	-	-	-	160
Activity Specific	200	-	-	-	-	200	-	-	-	-	-	-
Total TSS	**13,000**	**170**	**1,100**	**510**	**200**	**880**	**3,800**	**1,300**	**740**	**1,400**	**700**	**10,700**
Energy Use (billion Btu/year)												
Lodging	190,000	2,500	17,000	5,100	1,300	7,800	46,000	24,000	11,000	26,000	11,000	150,000
Restaurant	36,000	460	2,900	2,400	940	2,700	16,000	2,300	2,100	2,300	1,800	34,000
Retail	16,000	560	1,500	2,300	2,000	2,400	400	520	-	-	-	9,700
Activity Specific	18,000	5,600	-	-	-	-	-	1,900	9,900 **	-	400 **	18,000
Total Energy Use	**260,000**	**9,100**	**22,000**	**9,700**	**4,200**	**13,000**	**63,000**	**28,000**	**23,000**	**28,000**	**13,000**	**210,000**
Transportation Energy Use (Billion Btu/year)	**2,700,000**	**50,000**	**46,000**	**220,000**	**97,000**	**120,000**	**1,100,000**	**120,000**	**250,000**	**190,000**	**280,000**	**2,500,000**

Results are based on the methodology and limitations described in this report.

[1] "Trips" refers to any trip regardless of distance (including excursions less than 50 miles each way).

BOD: Biological Oxygen Demand, TSS: Total Suspended Solids, CO: carbon monoxide, NO_x: nitrogen oxides, HC: hydrocarbons, CO_2: carbon dioxide

* See Appendix A: Methodology for the derivation of snowmaking resource consumption.

** Not based on statistically significant survey data.

Table 2: Key Outputs By Subsector (continued)

	Tourism & Recreation Total	Skiing	Golfing	Fishing	Hunting	Boating	Waterside	Conventions	Amusement Parks	Museums/ Historical	Casino Gaming	Total for Subsectors
Municipal Waste Generation (tons/year)												
Lodging	2,800,000	14,000	96,000	77,000	19,000	120,000	700,000	360,000	57,000	150,000	67,000	1,700,000
Restaurant	5,600,000	28,000	440,000	360,000	180,000	422,000	2,500,000	360,000	320,000	350,000	270,000	5,200,000
Retail	410,000	14,000	39,000	58,000	50,000	63,000	10,000	13,000	-	-	-	250,000
Activity Specific	610,000	77,000	-	-	-	180,000	38,000	1,200 **	320,000 **	4,500	-	610,000
Total Municipal Waste Generated	**9,400,000**	**130,000**	**580,000**	**498,673**	**246,665**	**780,000**	**3,200,000**	**730,000**	**700,000**	**510,000**	**337,000**	**7,700,000**
Air Emissions (tons/year)												
Hydrocarbons												
Lodging	830	11	76	23	5.7	35	210	100	51	110	50	670
Restaurant	96	1.2	7.6	6.2	3.0	7.3	42	6.1	5.5	6.1	4.7	90
Retail	19	0.7	1.9	2.8	2.4	3.0	0.5	0.6	-	-	-	12
Activity Specific	620,000	18 *	4,900	-	-	610,000	-	-	-	-	-	620,000
Transportation	970,000	10,000	15,000	130,000	57,000	60,000	550,000	17,000	49,000	30,000	140,000 **	1,100,000
Total Hydrocarbon Emissions	**1,600,000**	**10,000**	**20,120**	**130,000**	**57,000**	**670,000**	**550,000**	**17,000**	**49,000**	**30,000**	**140,000**	**1,700,000**
CO												
Lodging	9,600	130	880	260	66	400	2,400	1,200	590	1,300	580	7,800
Restaurant	1,600	20	130	100	51	120	710	100	92	100	78	1,500
Retail	320	1.6	26	21	10	24	140	21	18	20	16	300
Activity Specific	2,600,000	54 *	260,000	-	-	2,300,000	-	-	-	-	-	2,600,000
Transportation	7,200,000	73,000	110,000	980,000	430,000	450,000	4,100,000	110,000	351,000	210,000	1,100,000 **	8,000,000
Total CO Emissions	**9,800,000**	**73,000**	**370,000**	**980,000**	**430,000**	**2,760,000**	**4,100,000**	**110,000**	**352,000**	**210,000**	**1,100,000**	**10,600,000**
NOx												
Lodging	11,000	150	1,000	300	76	470	2,800	1,400	680	1,500	670	9,000
Restaurant	1,300	17	100	87	43	100	590	86	77	85	65	1,300
Retail	330	1.6	26	21	10	25	140	21	19	21	16	300
Activity Specific	48,000	220 *	1,700	-	-	46,000	-	-	-	-	-	48,000
Transportation	530,000	6,000	8,400	68,000	30,000	32,000	290,000	11,000	29,000	19,000	76,000 **	570,000
Total NOx Emissions	**590,000**	**6,400**	**11,000**	**68,000**	**30,000**	**79,000**	**290,000**	**13,000**	**30,000**	**21,000**	**77,000**	**630,000**
CO2 Equivalents (thousand tons/year)												
Lodging	52,000	680	4,700	1,400	350	2,200	13,000	6,500	3,200	7,100	3,100	42,000
Restaurant	9,100	110	720	590	290	690	4,000	580	520	580	440	8,500
Retail	3,500	120	340	500	430	540	88	110	-	-	-	2,100
Activity Specific	14,000	760 *	-	-	-	13,000	-	-	-	-	-	14,000
Transportation	260,000	4,300	4,300	24,000	11,000	13,000	120,000	9,700	21,000	16,000	29,000 **	250,000
Total for CO2 equivalents	**340,000**	**6,000**	**10,000**	**26,000**	**12,000**	**30,000**	**137,000**	**17,000**	**25,000**	**24,000**	**33,000**	**317,000**

Results are based on the methodology and limitations described in this report.

BOD: Biological Oxygen Demand, TSS: Total Suspended Solids, CO: carbon monoxide, NO_x: nitrogen oxides, HC: hydrocarbons, CO_2: carbon dioxide

* See Appendix A: Methodology for the derivation of snowmaking resource consumption.

** Not based on statistically significant survey data.

Figure 1: Total Water Use for Selected Activity Subsectors

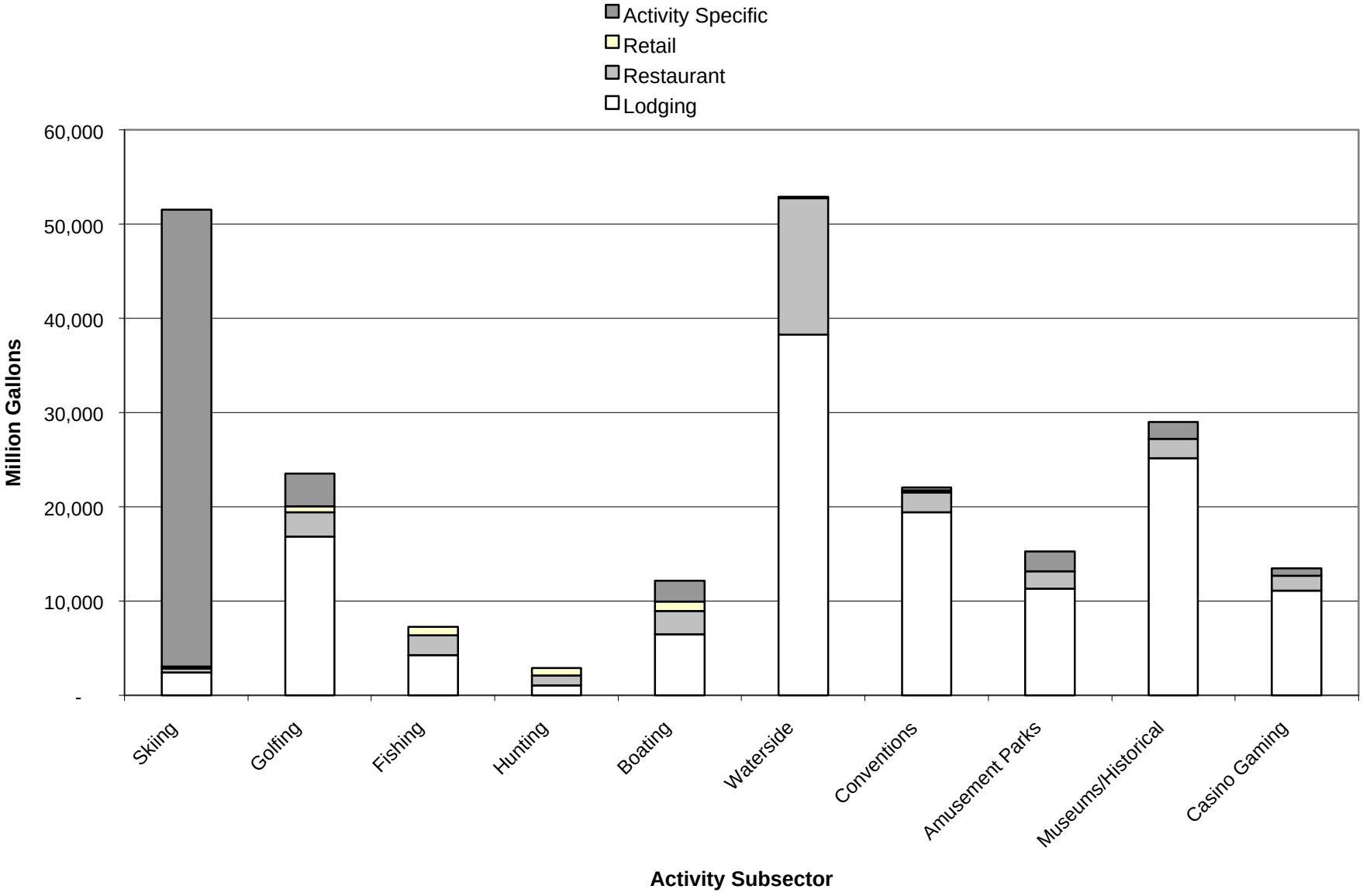
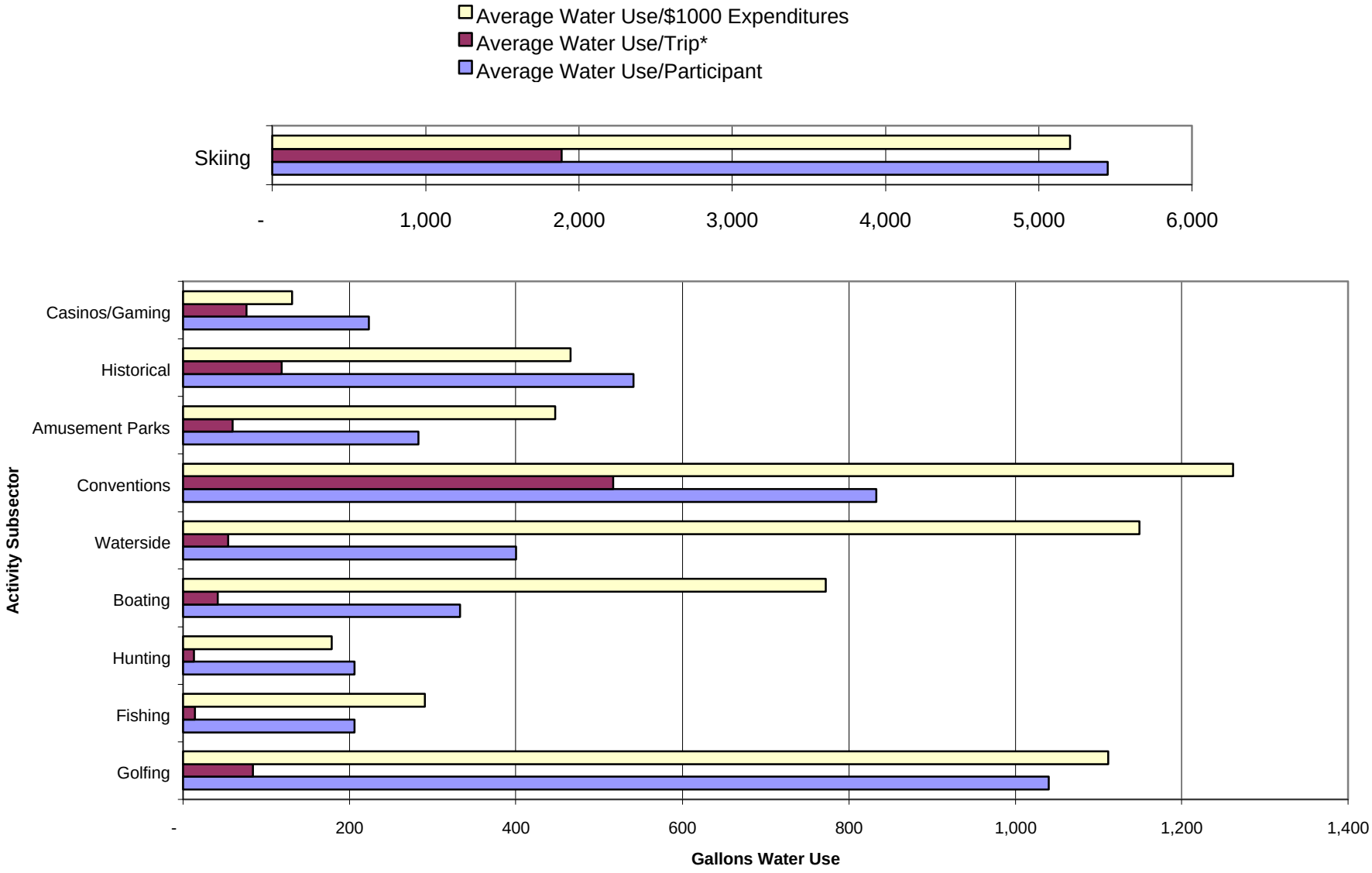
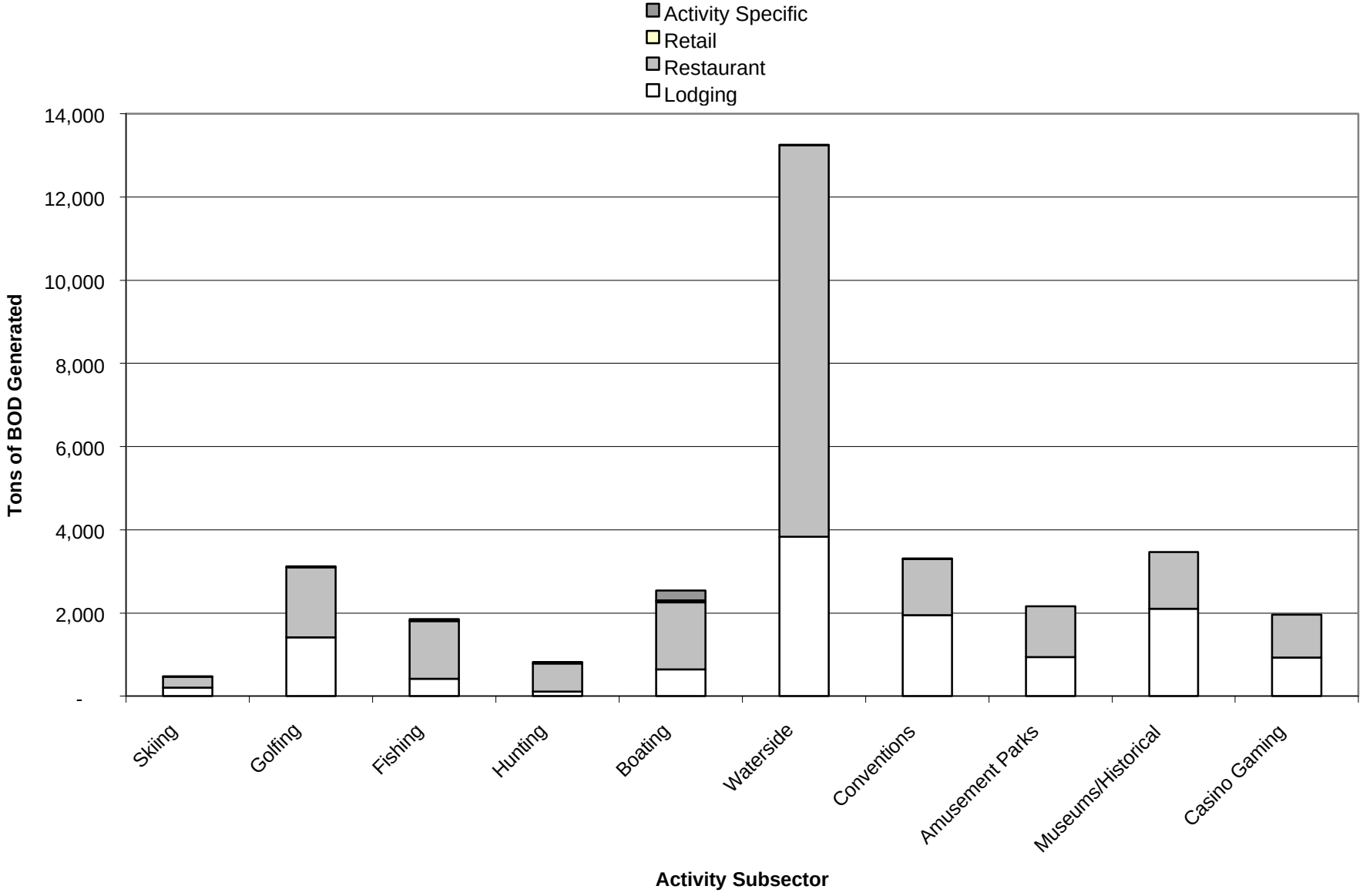


Figure 2: Average Water Use Per Selected Activity Subsector



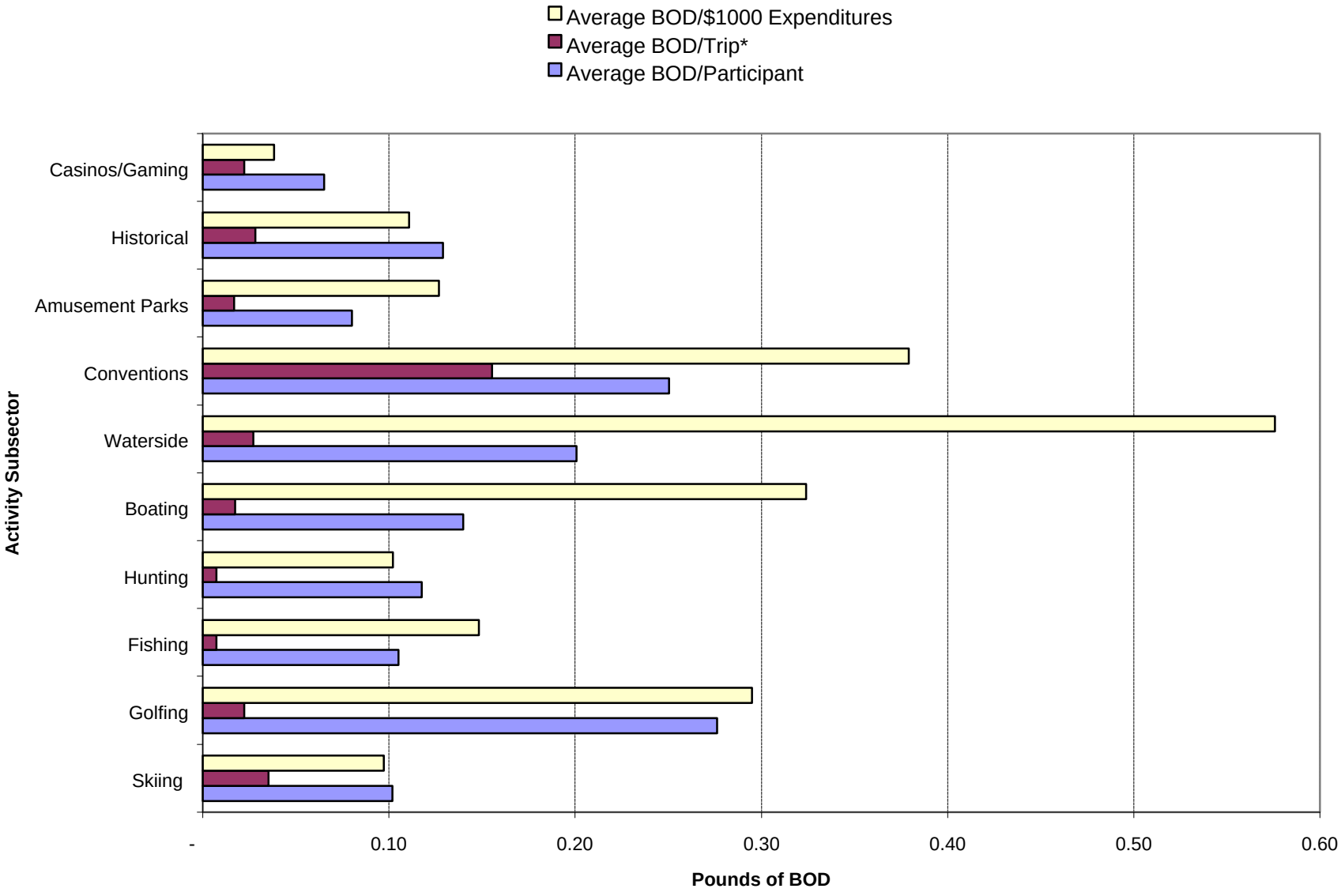
* ”Trip” refers to any trip regardless of distance (including excursions less than 50 miles each way).

Figure 3: Total BOD Generation for Selected Activity Subsectors



BOD: Biological Oxygen Demand

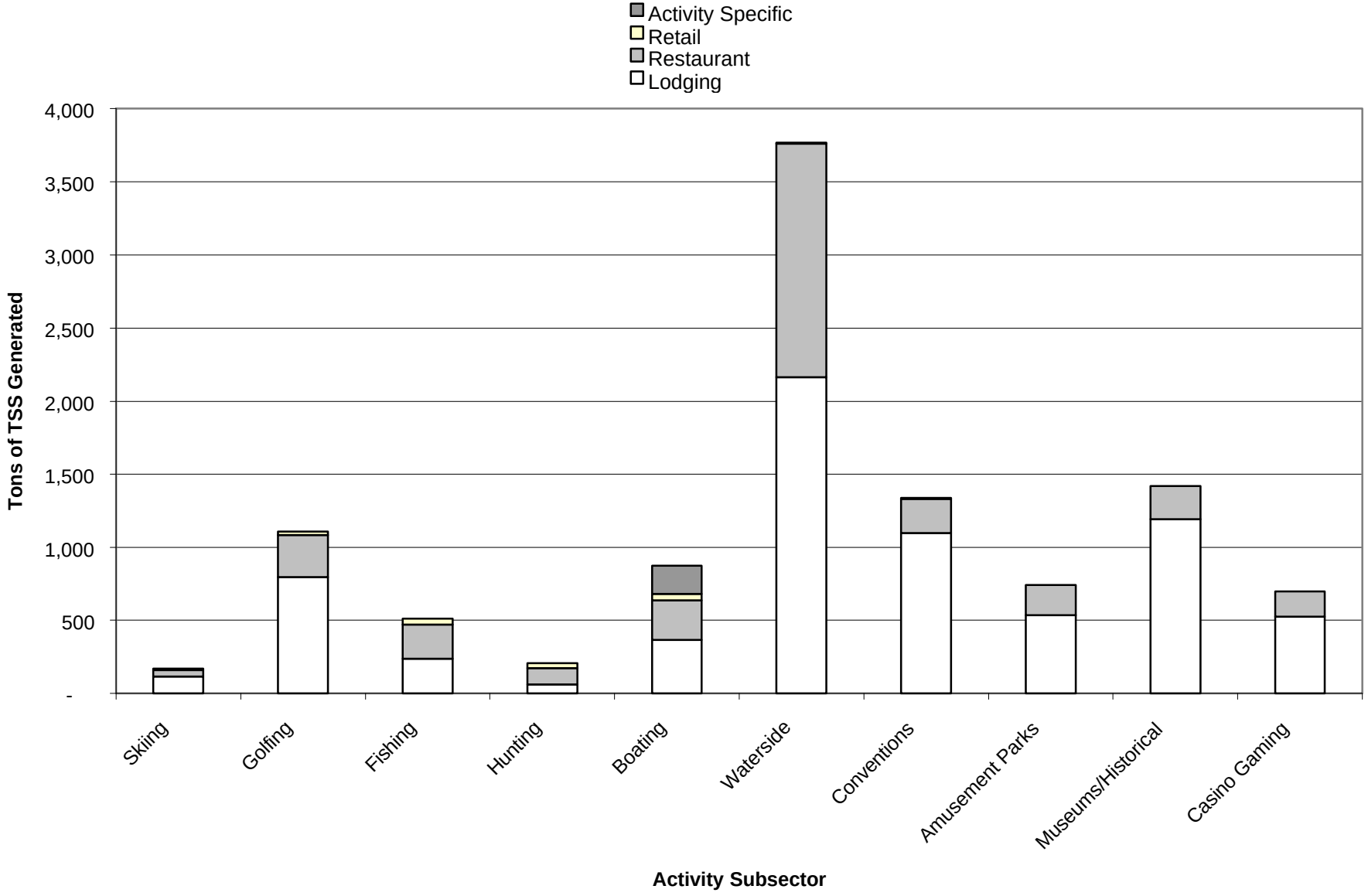
Figure 4: Average 5-day BOD Generation for Selected Activity Subsectors



BOD: Biological Oxygen Demand

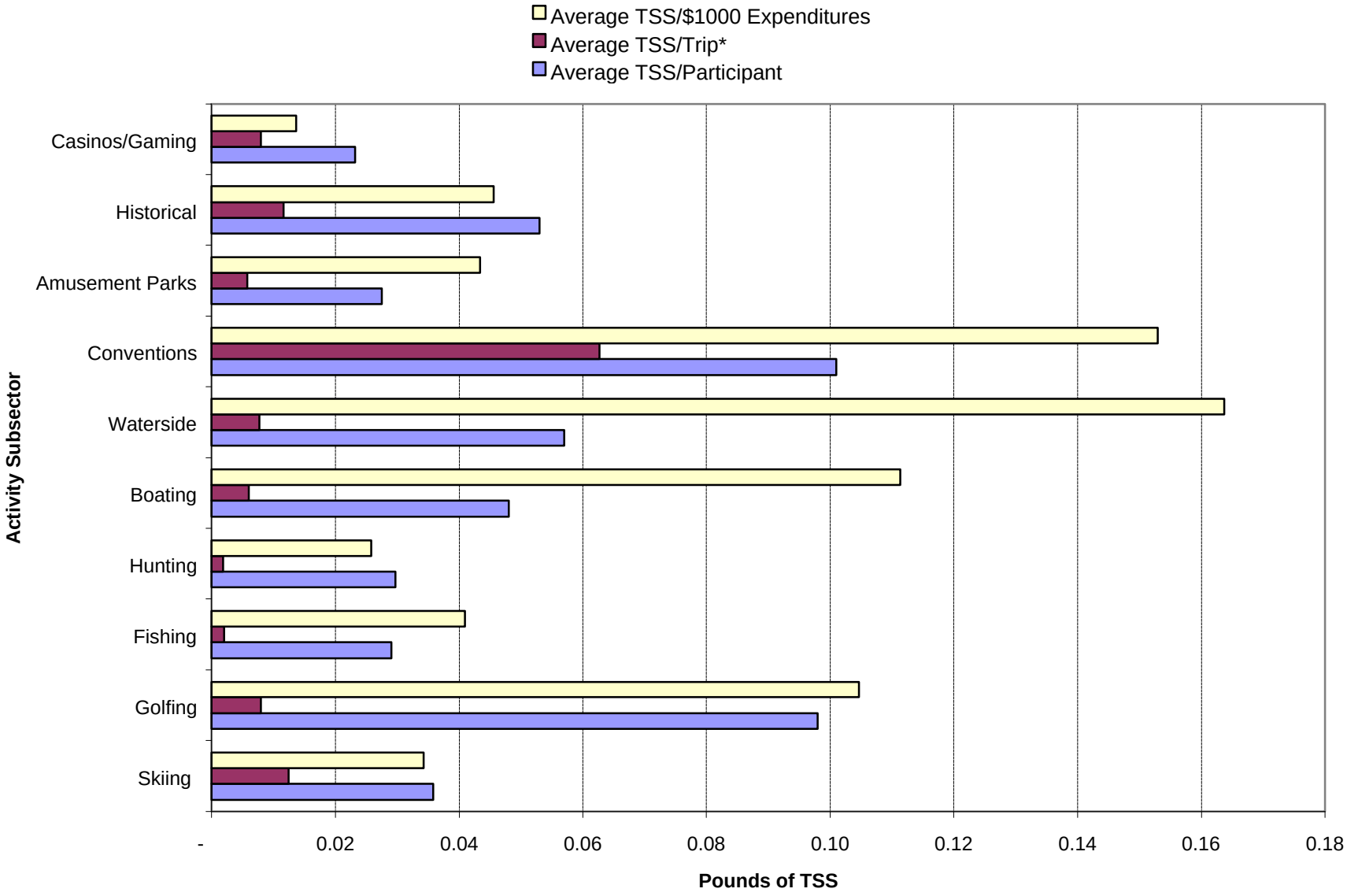
* "Trip" refers to any trip regardless of distance (including excursions less than 50 miles each way).

Figure 5: Total TSS Generated for Selected Activity Subsectors



TSS: Total Suspended Solids

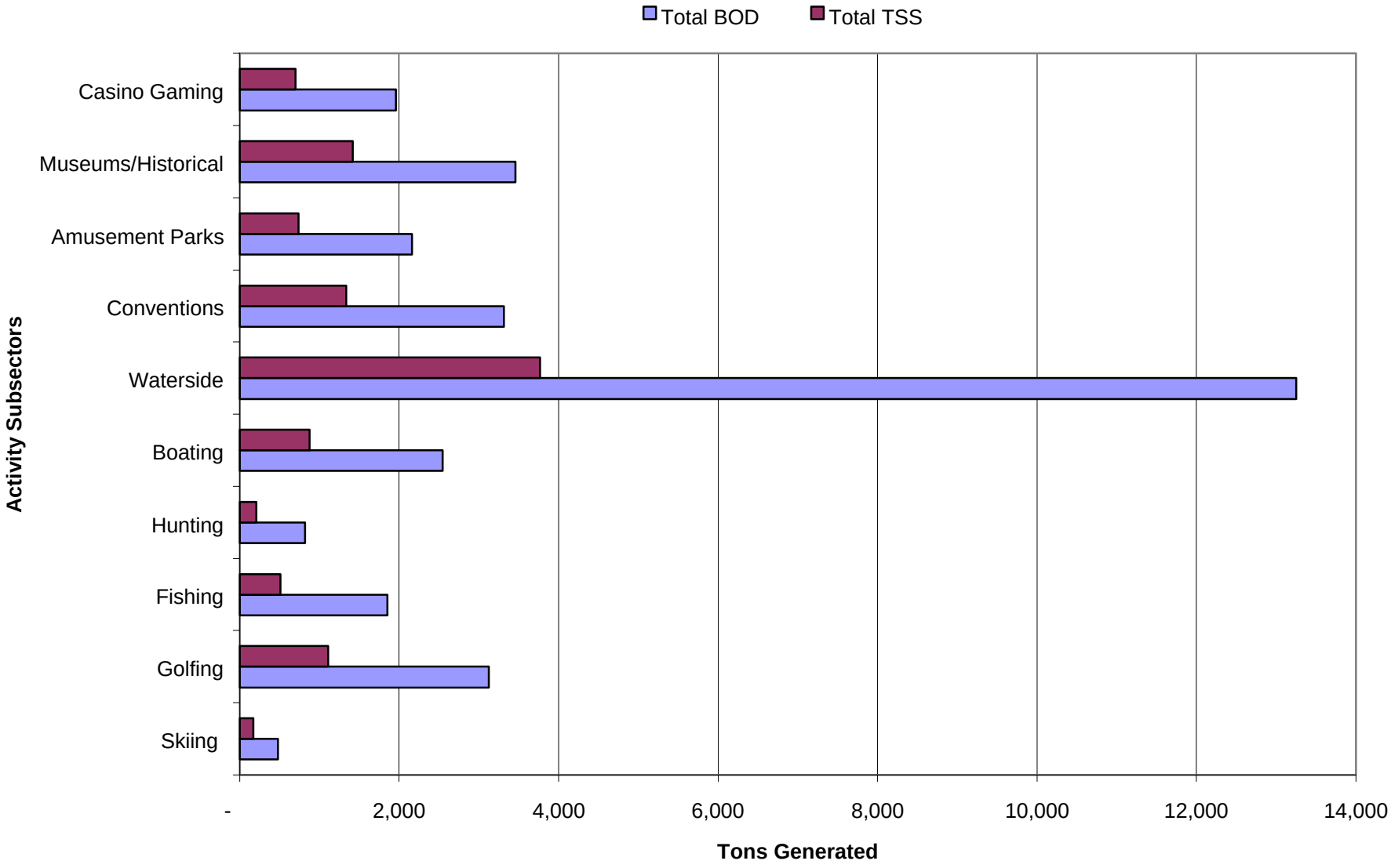
Figure 6: Average TSS Generation for Selected Activity Subsectors



TSS: Total Suspended Solids

* ”Trip” refers to any trip regardless of distance (including excursions less than 50 miles each way).

Figure 7: Total BOD and TSS Generation for Selected Activity Subsectors



BOD: Biological Oxygen Demand
TSS: Total Suspended Solids

Figure 8: Total Energy Use for Selected Activity Subsectors

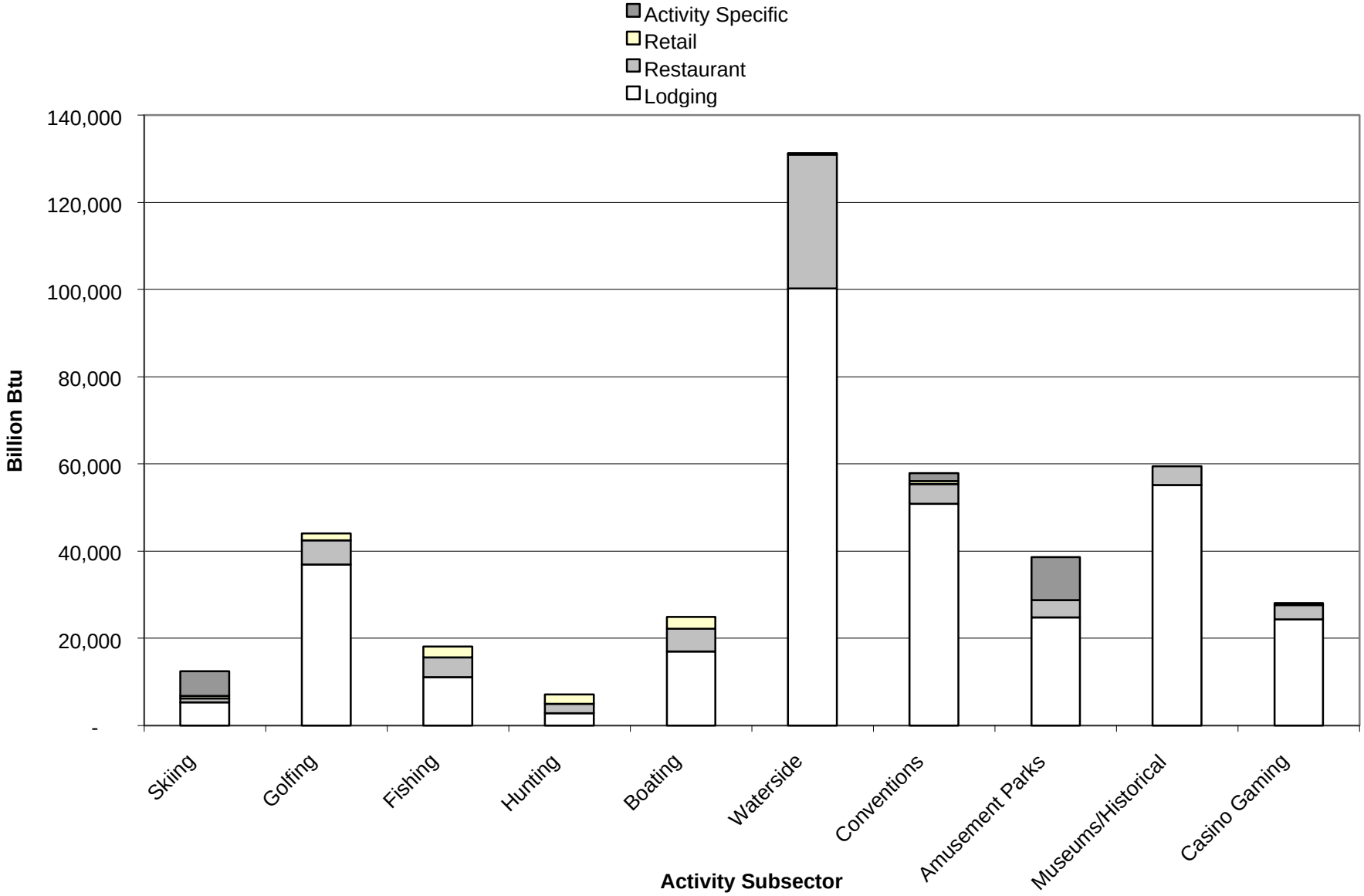
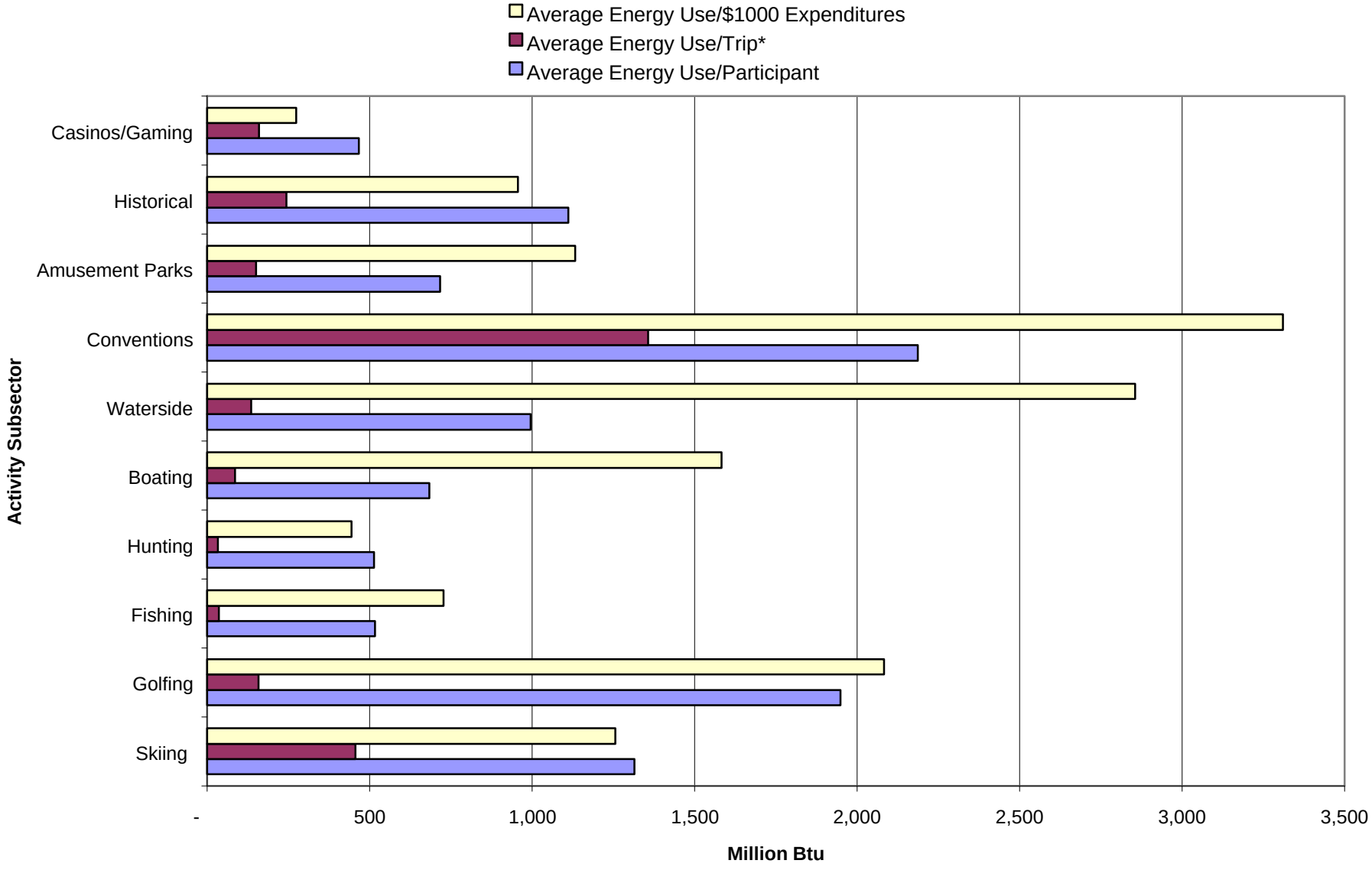


Figure 9: Average Energy Use For Selected Activity Subsectors



* ”Trip” refers to any trip regardless of distance (including excursions of less than 50 miles each way).

Figure 10: Total Transportation Energy Use for Selected Activity Subsectors

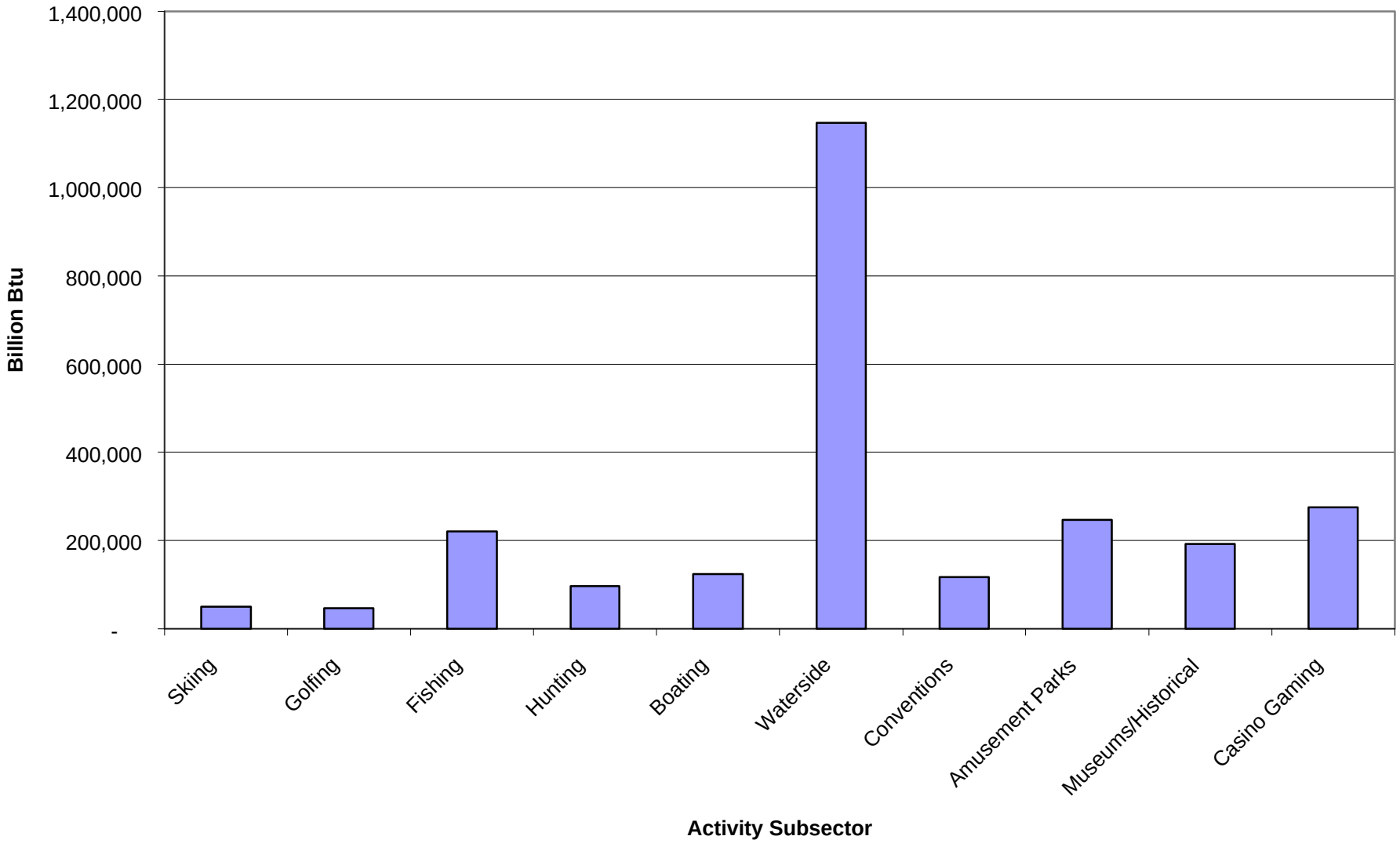


Figure 11: Total Waste Generation for Selected Activity Subsectors

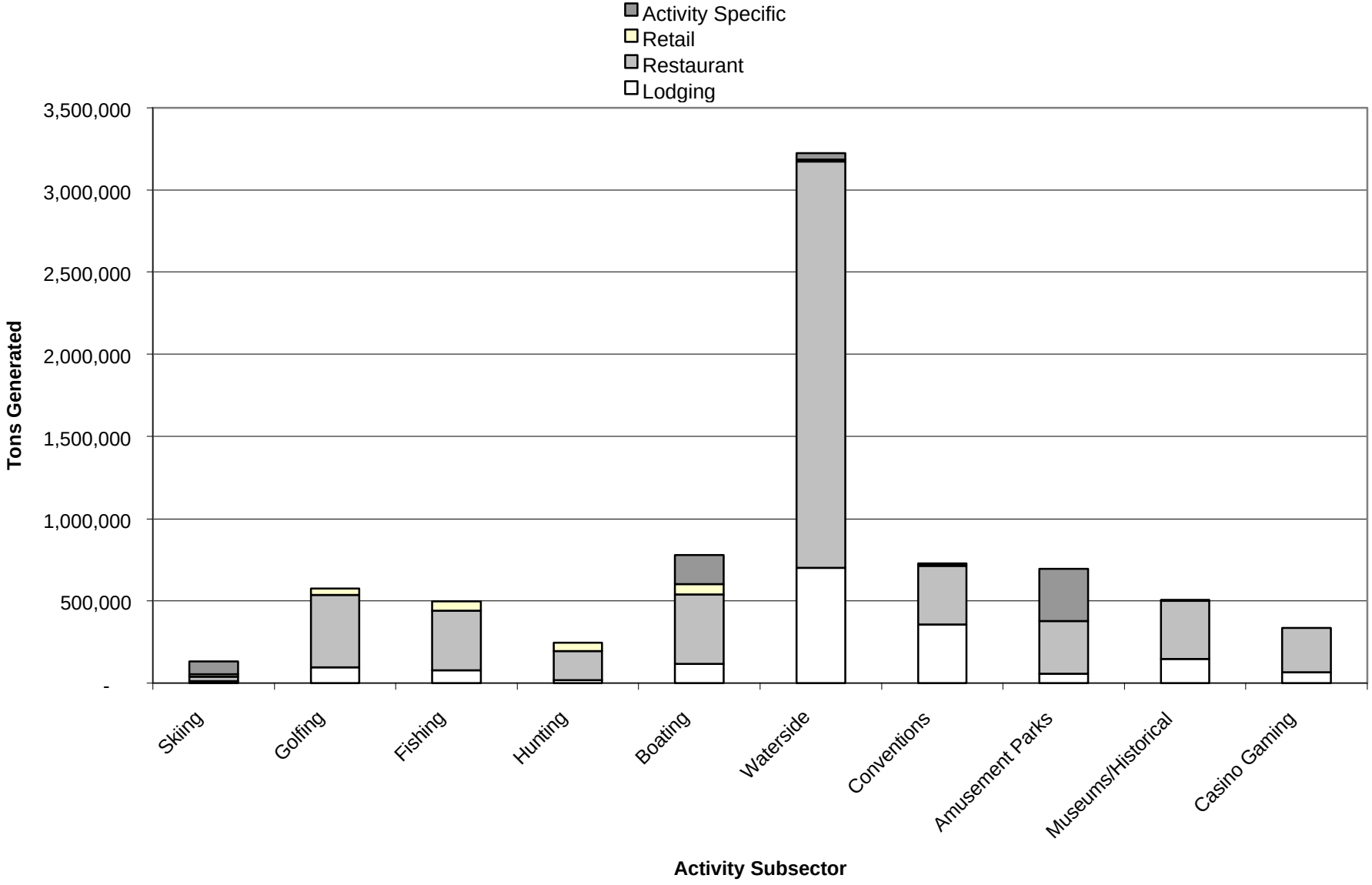
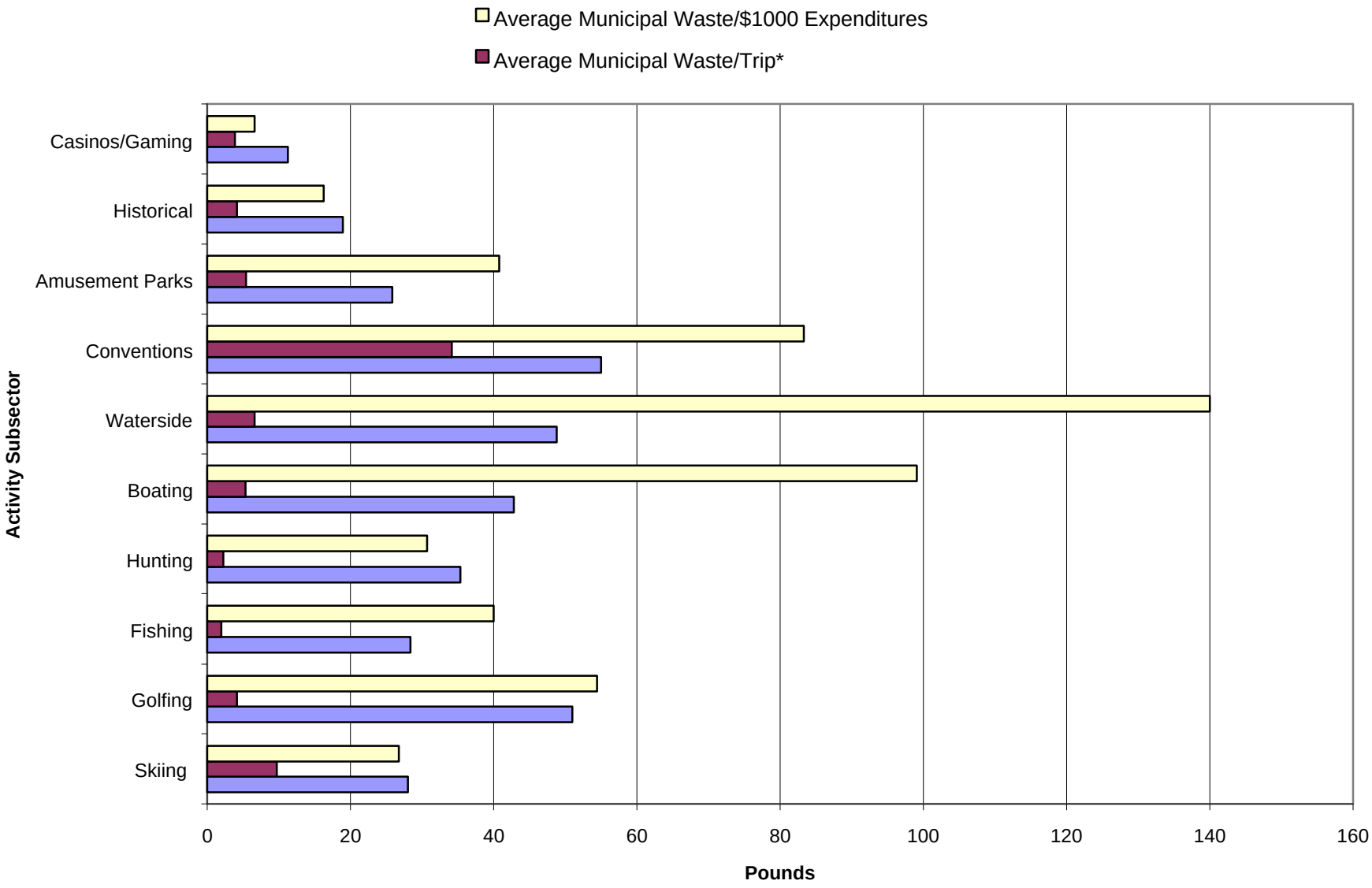
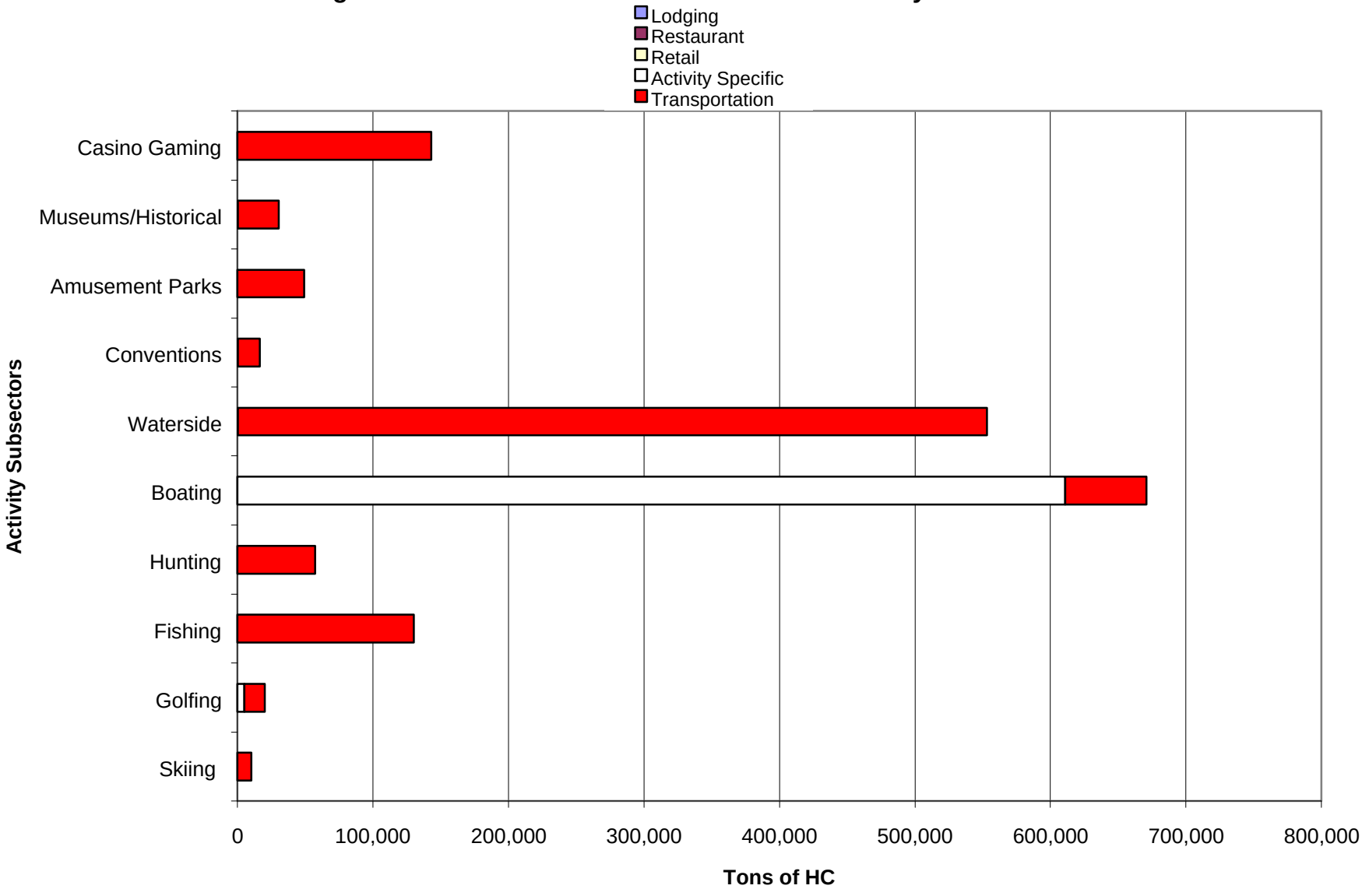


Figure 12: Average Waste Generation For Selected Activity Subsectors



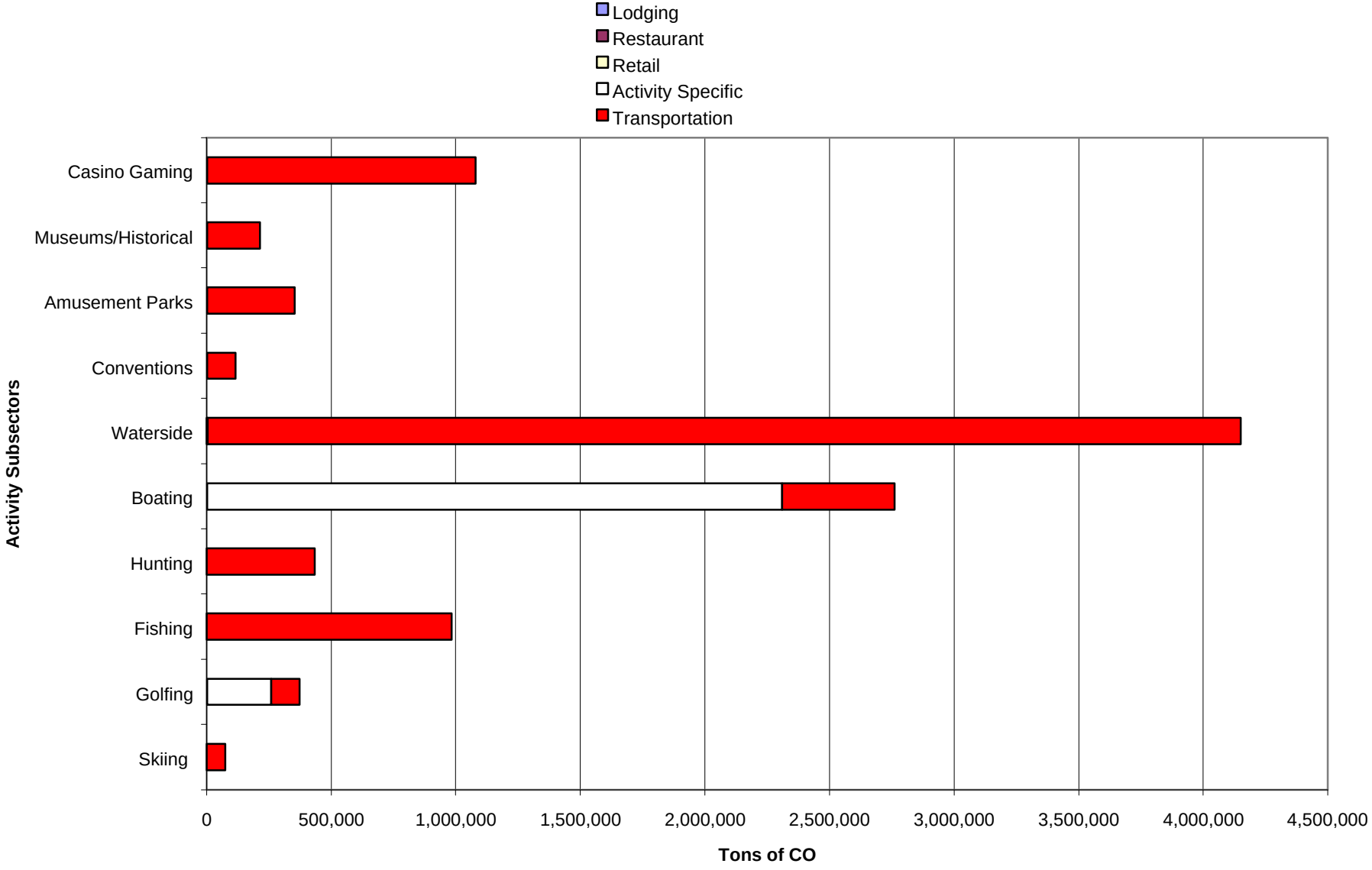
* "Trip" refers to any trip regardless of distance (including excursions of less than 50 miles each way).

Figure 13: Total HC Emissions for Selected Activity Subsectors



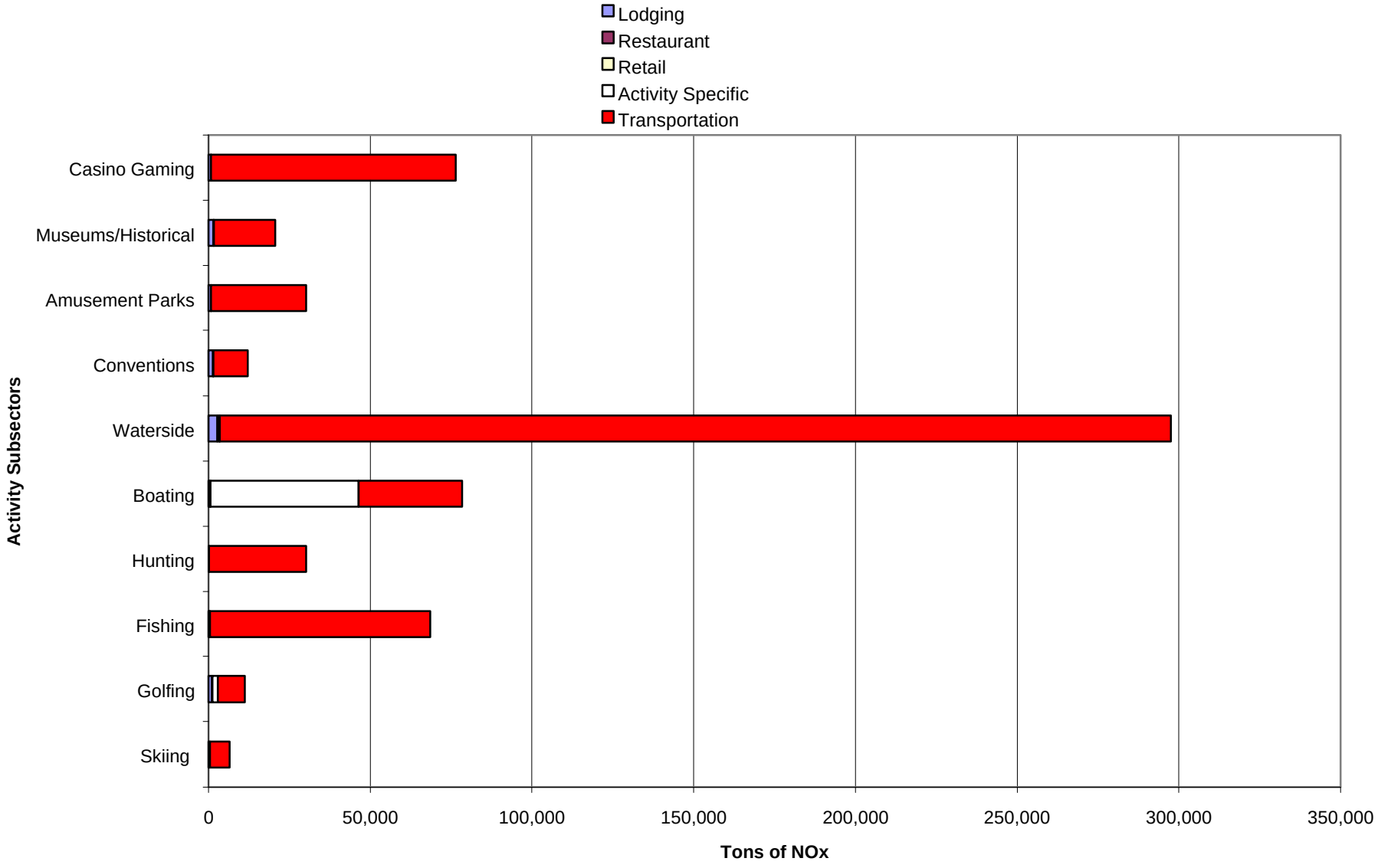
HC: Hydrocarbons

Figure 14: Total CO Emissions for Selected Activity Subsectors



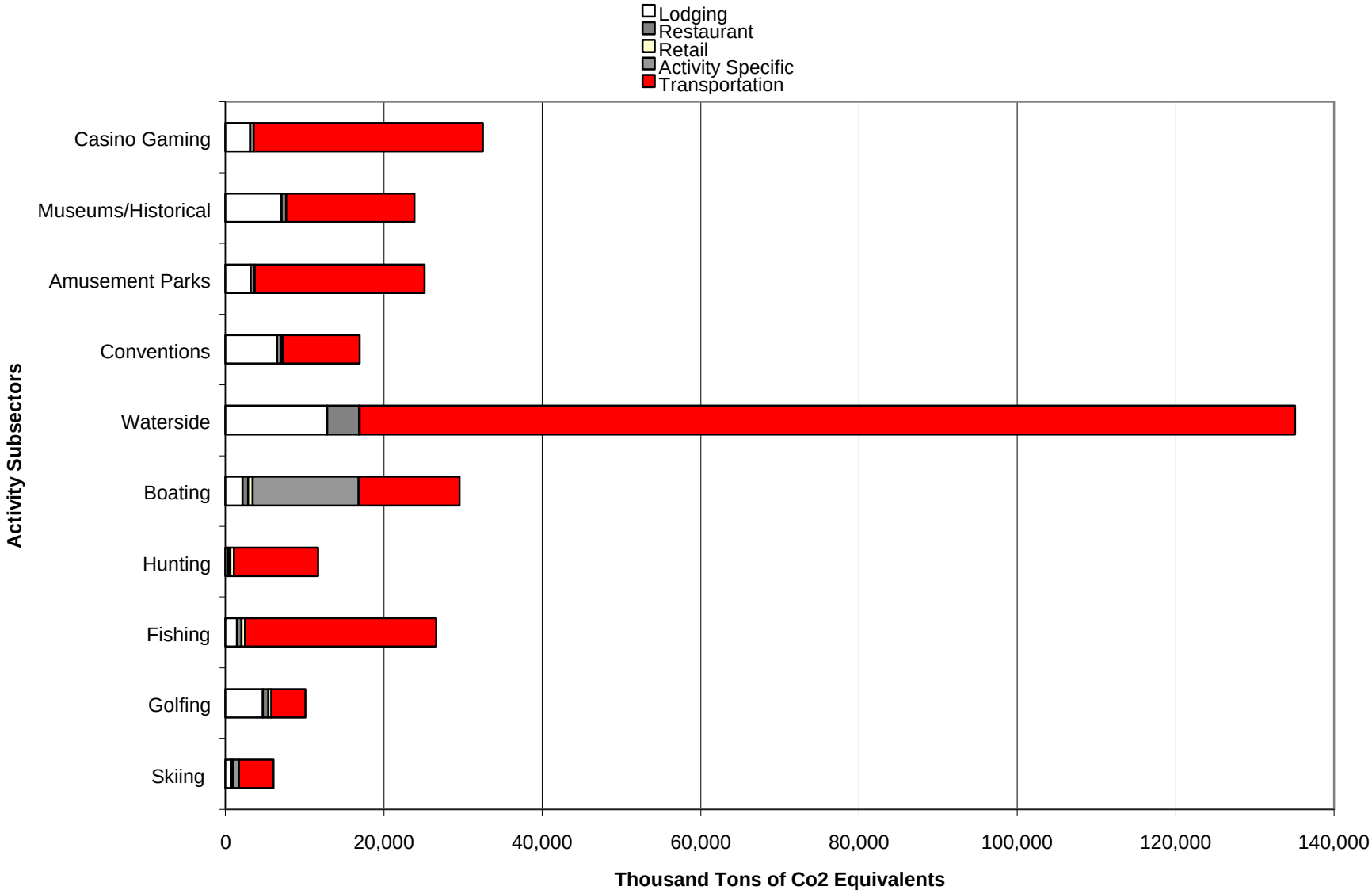
CO: Carbon monoxide

Figure 15: Total NOx Emissions for Selected Activity Subsectors



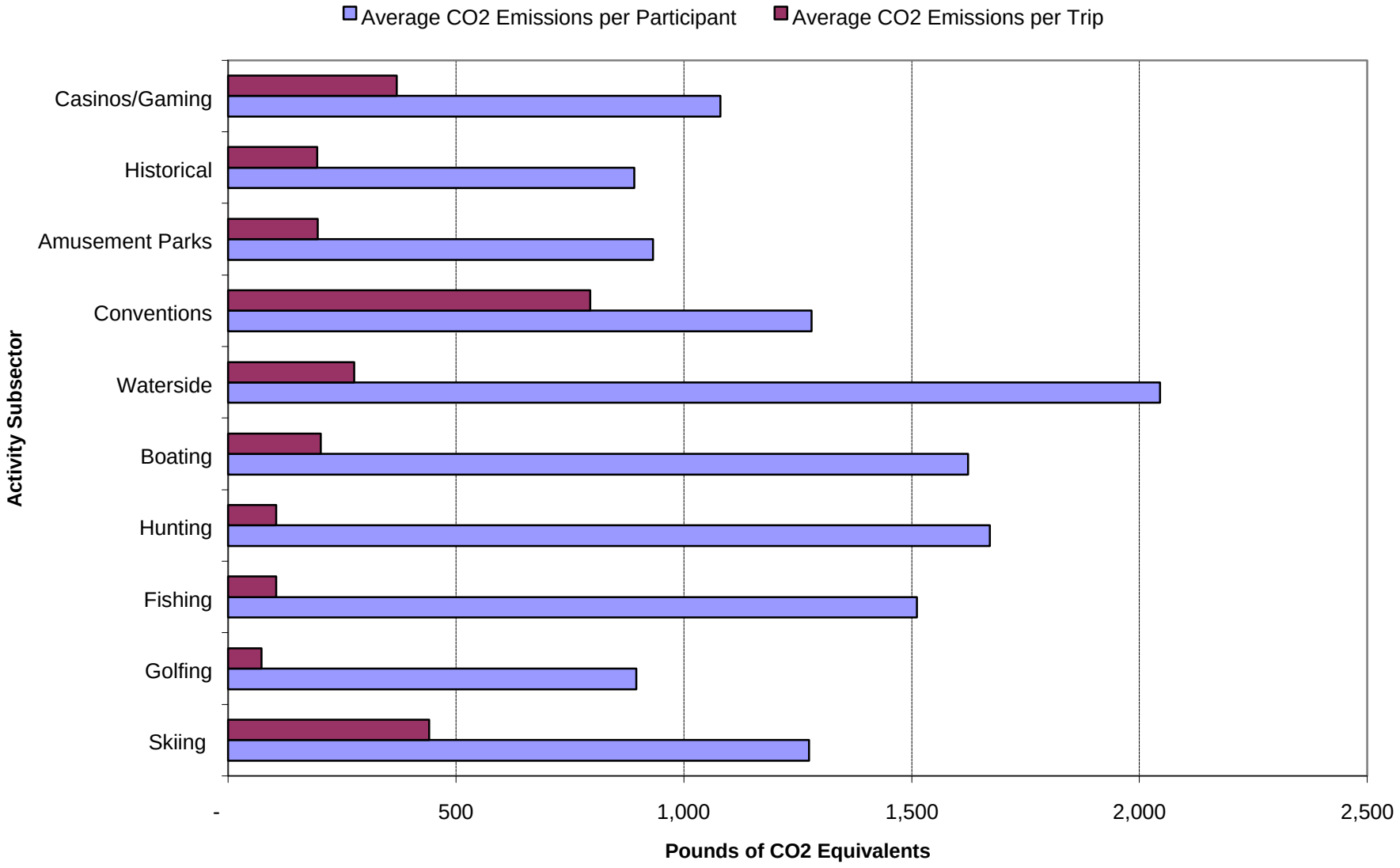
NO_x: Nitrogen Oxides

Figure 16: Total CO2 Equivalent Emissions for Selected Activity Subsectors



CO_2: Carbon Dioxide

Figure 17: Average Greenhouse Gas Emissions for Selected Activity Subsectors



CO_2: Carbon Dioxide

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APPENDIX A: METHODOLOGY

Introduction

Each tourism and recreation activity included in this model generates economic and environmental impacts. Some impacts are common to all of the activities, such as those associated with the supply industries (hotels, transportation, restaurants, and retail). Other impacts are specific to the activity. This Appendix describes how each set of impacts was developed and incorporated into the model.

In general, the environmental impacts of the supply industries are held constant in this model and will not vary with each activity. These include the gallons of water used in a hotel per night by each guest and the pounds of solid waste generated in a restaurant per dollar of expenditure. Activity-specific environmental impacts (e.g., water use for snowmaking) are calculated individually for each activity.

In order to apply these environmental impacts to the specific activities, the next step is to collect demographic and trip characteristics information. For example, it is necessary to know how often participants take part in an activity, how far they travel to get there, how long they stay per trip, and how much money they spend. Each of these pieces of information is activity-specific, and often can be obtained from industry and government surveys.

The form of these data can vary depending on the source. As a result, two methodologies were developed: 1) participation and 2) expenditure. Section A of this Appendix describes these two methodologies.

Section B discusses the methodology used to compile the impacts of the five categories of industries in this model: lodging, restaurants, retail, transportation, and activity-specific. The section describes the type of information collected for each category and included in the model.

Section C presents the methodologies used to generate calculations for activity-specific impacts. For each activity, the data sources, any comments or qualifications about the data, and any estimates/assumptions used to adapt the available data to the model are discussed.

Section A: Comparison of the Two Methodologies

The form and detail of subsector demographic data can vary. Some provide detailed information about individual behavior of participants in the industry; for example, the available studies for casinos contain information about the average number of days spent at casinos, the percent that result in overnight stays, etc. In this case, it was possible to compute the economic and environmental effects on a participation basis (Method I).

For other industries, information is only available in an aggregated form. Data are often reported in financial terms, including gross industry sales and the amount spent on utilities. In these cases, the impacts were measured according to expenditures (Method II).

Further descriptions of the two methodologies are provided below. Whenever possible, estimates were developed under both methodologies, and the estimate with the more reliable input data was selected.

1. Method I: Participation

This method directly calculates the impacts per participant. It combines activity-specific information (e.g., number of lodging days and number of meals) with the general environmental measures for each category (e.g., average gallons of water, Btus, and pounds of municipal solid waste). In order to arrive at activity-specific, per-person data, the following parameters are often used:

- **Number of participants:** The number of participants is generally the most fundamental variable in the participation methodology. This variable is frequently used to determine the number of participant trips, participation days, lodging days, and meals.

- **Total participant trips:** In the model, participant trips are differentiated into day trips and overnight trips. This differentiation is important because lodging impacts are only associated with overnight trips. Participant trips and average overnight stay length are used to calculate the number of participation days.

- **Number of participation days:** This variable is a direct input into the estimation of both hotel days and meals. This variable is often calculated from the number of participants, their number of trips, and average trip length. Similar to participant trips, participation days are also divided into day-trip

days and overnight days. The model's assumption for the number of meals purchased generally depends on if it is a day-trip day or an overnight trip day.

- **Average overnight stay length:** Together with the number of total participation trips, the average overnight stay length is used to calculate the number of participation days. In addition, this number is used to differentiate between regular hotel days and checkout hotel days. For the estimation of municipal solid waste generation, this distinction is important as a larger amount of waste is assumed for checkout days than for regular days.

TABLE A-1: INPUTS FOR METHOD I		
Impact Category	**Subsector Variables**	**Environmental Measures**
Lodging		
Water Use	Total lodging days	Average gallons/hotel-day
BOD Generation	Total lodging days	Average lb/hotel-day
TSS Generation	Total lodging days	Average lb/hotel-day
Energy Use	Total lodging days	Average Btu/hotel-day
CO Emissions	Total lodging days	Average lb/hotel-day
NOx Emissions	Total lodging days	Average lb/hotel-day
HC Emissions	Total lodging days	Average lb/hotel-day
Greenhouse Gas Emissions	Total lodging days	Average lb/hotel-day
Municipal Solid Waste Generation	Regular lodging days Checkout lodging days	Average lb/hotel-day Average lb/checkout-day
Restaurants		
Water Use	Total meals	Average gallons/meal
BOD Generation	Total meals	Average lb/meal
TSS Generation	Total meals	Average lb/meal
Energy Use	Total meals	Average Btu/meal
CO Emissions	Total meals	Average lb/meal
NOx Emissions	Total meals	Average lb/meal
HC Emissions	Total meals	Average lb/meal
Greenhouse Gas Emissions	Total meals	Average lb/meal

2. Method II: Expenditures

The model also uses the expenditures method to estimate water use, energy use, and municipal solid waste generation for lodging, restaurants, and retail when expenditure data are available. This method is driven by three principal subsector variables: subsector-specific hotel expenditures, restaurant expenditures, and retail expenditures. As with Method I, these subsector variables are combined with constant environmental measures to obtain each subsector's environmental indicator values for lodging, restaurants, and retail. The environmental measures used in the participation methodology are average gallons of water, Btus, and pounds of municipal solid waste per hotel dollar, per restaurant dollar, and per retail dollar spent.

In contrast to the participation method, the subsector-specific expenditure data are generally more readily available than participation data. This method therefore does not rely on additional calculations to the same extent as the participation method. Table A-2 below presents the subsector variables and environmental measures used in this method.

TABLE A-2: INPUTS FOR METHOD II		
Impact Category	**Subsector Variables**	**Environmental Measures**
Lodging		
Water Use	Hotel expenditures	Average gallons/hotel $
BOD Generation	Hotel expenditures	Average lb/hotel $
TSS Generation	Hotel expenditures	Average lb/hotel $
Energy Use	Hotel expenditures	Average Btu/hotel $
CO Emissions	Hotel expenditures	Average lb/hotel $
NOx Emissions	Hotel expenditures	Average lb/hotel $
HC Emissions	Hotel expenditures	Average lb/hotel $
Greenhouse Gas Emissions	Hotel expenditures	Average lb/hotel $
Municipal Solid Waste Generation	Hotel expenditures	Average lb/hotel $
Restaurants		
Water Use	Restaurant expenditures	Average gallons/restaurant $
BOD Generation	Restaurant expenditures	Average lb/restaurant $
TSS Generation	Restaurant expenditures	Average lb/restaurant $
Energy Use	Restaurant expenditures	Average Btu/restaurant $
CO Emissions	Restaurant expenditures	Average lb/restaurant $
NOx Emissions	Restaurant expenditures	Average lb/restaurant $
HC Emissions	Restaurant expenditures	Average lb/restaurant $
Greenhouse Gas Emissions	Restaurant expenditures	Average lb/restaurant $
Municipal Solid Waste Generation	Restaurant expenditures	Average lb/restaurant $

TABLE A-2: INPUTS FOR METHOD II		
Impact Category	**Subsector Variables**	**Environmental Measures**
Retail		
Water Use	Retail expenditures	Average gallons/retail $
BOD Generation	Retail expenditures	Average lb/retail $
TSS Generation	Retail expenditures	Average lb/retail $
Energy Use	Retail expenditures	Average Btu/retail $
CO Emissions	Retail expenditures	Average lb/retail $
NOx Emissions	Retail expenditures	Average lb/retail $
HC Emissions	Retail expenditures	Average lb/retail $
Greenhouse Gas Emissions	Retail expenditures	Average lb/retail $
Municipal Solid Waste Generation	Retail expenditures	Average lb/retail $

Section B: The Five Impact Categories

As outlined in the report, this model addresses economic and environmental impacts associated with four supply sectors of various tourism and recreation subsectors, plus the activities themselves. The five categories considered are: (1) lodging, (2) restaurants, (3) retail, (4) transportation, and (5) the tourism or recreation activity itself. This section discusses all five categories in terms of data inputs and methodologies used to estimate environmental impacts from the various subsectors.

1. Lodging

Environmental indicators for lodging considered in this model include water use, wastewater, energy use, greenhouse gas emissions, and municipal solid waste generation. The data were used to calculate indicators via both methods described in Section A of this Appendix. Much of the lodging information is based on the *1997 Lodging Industry Profile* by the American Hotel and Motel Association. This report contains information on the number of hotel/motel rooms in the United States, average occupancy rate, average room rate, and total sales. Other sources of market information include the *U.S. Travel and Tourism Satellite Accounts*, *Statistical Abstract of the United States 1997*, and the TIA reports *Tourism Works for America* and *Travel Market Report.*

Environmental information was collected from several sources. Water use was obtained from the EPA WAVE Program. Wastewater was calculated from BOD and TSS concentrations listed in the *CRC Handbook of Environmental Control* and was reduced based on average efficiency of wastewater treatment facilities in the United States as provided in the *1996 CNWS report to Congress and the Water Environment Federation.* Energy consumption was obtained from the *Commercial Buildings Energy Consumption Survey (CBECS)*, published by the U.S. Department of Energy (DOE) Energy Information Administration. Air pollutant emissions were calculated from the CBECS data and with conversion factors listed in *Compilation of Air Pollutant Emission Factors (AP-42), Chapter 1: External Combustion Sources*, published by U.S. EPA. Greenhouse gas emissions are based on the energy figures produced by DOE and through conversion provided by the U.S. EPA document, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-1997*. Solid waste generation figures were obtained from the article, “Waste Management and Resource Recovery” by Roy Westerman in *Resource Recycling*, 1991.

2. Restaurants

Environmental indicators for restaurants considered in this model include water use, wastewater, energy use, greenhouse gas emissions, and municipal solid waste generation. The data were used to calculate indicators via both methods described in Section A. Industry information was obtained from the *U.S. Travel and Tourism Satellite Accounts*, the National Restaurant Association, and the *Statistical Abstract of the United States, 1997*.

Water use data were obtained from the *Water Resources Handbook*. Wastewater information was derived from *Water and Wastewater Treatment* and the *CRC Handbook of Environmental Control* and was reduced based on average efficiency of wastewater treatment facilities in the U.S.. Energy data were obtained from DOE's CBECS database. Air pollutant emissions and greenhouse gas emissions were based on CBECS data and determined through conversion factors provided in *AP-42, Chapter 1* and the *Inventory of U.S. Greenhouse Gas Emissions and Sinks*, respectively. Solid waste data were obtained from the article, "Waste Management and Resource Recovery."

3. Retail

Environmental indicators for retail considered in this model include water use, energy use, and solid waste generation. Unlike lodging and restaurants, retail uses only the expenditure method to calculate the indicators. Economic information was obtained from the *Statistical Abstract of the United States, 1997* and E Source.

Water use data were obtained from the *Water Resources Handbook*. Wastewater information was derived from *Water and Wastewater Treatment* and the *CRC Handbook of Environmental Control* and was reduced based on average efficiency of wastewater treatment facilities in the U.S.. Energy consumption information is based on DOE's CBECS database and information provided by E Source. Air pollutant emissions and greenhouse gas emissions are based on the CBECS data and factors from *AP-42, Chapter 1* and the *Inventory of U.S. Greenhouse Gas Emissions and Sinks*, respectively.

4. Transportation

Environmental indicators for transportation considered in this model include air pollutant emissions and greenhouse gas emissions. Two important statistics used for these transportation figures are the average Btu per car mile and per plane person-mile. Both of these were obtained from the U.S. Department of Transportation's

report, *National Transportation Statistics 1998*. Average miles traveled were determined on a subsector-specific basis.

Air pollutant emissions from cars were calculated from U.S. EPA Office of Mobile Sources emissions factors, while emissions from commercial airplanes were calculated from Department of Transportation estimates. Greenhouse gas emissions were calculated for cars and planes with emissions data presented in EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 1997.*

When applying the transportation-related environmental measures, the conceptual difference between car miles and plane person-miles should be noted. Car miles refer to the energy use and emissions *per vehicle* and therefore require an estimation of the occupancy rate in addition to passenger trips. Plane person-miles, on the other hand, refer to energy use and emissions *per passenger*; therefore, passenger trips do not have to be adjusted but can be applied directly to calculate the indicators.

5. Activity-Specific

Activity-specific environmental indicators for this model include all environmental categories discussed for the four supply-sectors above: water use, wastewater, energy use, air pollutant emissions, greenhouse gas emissions, and municipal solid waste generation. It should be noted, however, that activity-specific indicators are only calculated where data were available and where the activity was assumed to have an impact. For example, water use is an important factor in the activity-specific impacts of skiing. On the other hand, since no significant water use is expected from fishing, this measure was not calculated.

Depending on the tourism and recreation subsector in question, different input variables and methodologies are used. The specific approaches used are explained in the subsector discussions in Section C below.

TABLE A-3: INPUTS FOR TRANSPORTATION INDICATORS		
Impact Category	**Subsector Variables**	**Environmental Measures**
Transportation		
Energy Use	Vehicle miles for cars	Average Btu/car mile
	Person-miles for planes	Average Btu/plane person-mile
Air Emissions	Vehicle miles for cars	Average lb HC emission/car mile Average lb CO emission/car mile Average lb NOx emission/car mile
	Person-miles for planes	Average lb HC emission/plane person mile Average lb CO emission/plane person mile Average lb NOx emission/plane person mile
Greenhouse Gas Emissions	Vehicle miles for cars	Average lb CO2-equivalent emission/car mile
	Person-miles for planes	Average lb CO2-equivalent emission/plane person mile

Section C: Data Sources, Data Qualifications, and Estimates/Assumptions of Each Tourism and Recreation Sector

For each subsector the model requires the following input data:

- total participants,
- total trips,
- total days,
- total lodging days,
- total regular lodging days,
- total checkout lodging days, and
- total meals.

Much of these data can be obtained from industry and government surveys. However, the surveys vary by subsector and data are not always in the exact form required by the model. Often the model input data must be derived from the survey data, other sources, and estimates and assumptions made by industry experts and the project team. Descriptions of these data sources, the forms they are in, and any estimates or assumptions required to obtain the required input data are provided below for each activity subsector.

Skiing Subsector Data

Data Sources

Data for the skiing sector was compiled from a number of industry associations and market research publications. These include: *The Kottke National End of the Season Survey*, *1995/1996 Economic Analysis of United States Ski Areas*, and the *1996-97 Facts and Figures on the On-Snow Industry* all published by the National Ski Areas Association (NSAA). The NSAA reports primarily contain information on skier expenditures and resort characteristics. Skier travel behavior, such as average length of stay, transportation type, and travel time, were obtained from the *National Skier Opinion Survey* (NSOS) put together by Leisure Trends, Inc. in Boulder, CO.

Data Qualifications

The NSAA uses “skier visits” as the basis for its participation data. A skier visit represents one person visiting a ski area for all or any part of a day or night. A ski visit

may be for the purpose of skiing or snowboarding. This measure provided the basis for this analysis as well.

The actual number of overnight trips taken by skiers was not available. However, the NSOS data provided information on the percentage of skiers interviewed who were on an overnight trip and the average total number of days spent on overnight trips in a year. These data combined with participation data from NSAA were used to determine the number of overnight skiers and overnight trips. In estimating the number of overnight trips, it was assumed that each overnight skier only took one overnight trip. 6.8 million skiers were found to have been on overnight trips of an average length of 4.7 days. Then, based on an RRC Associates estimate, it was assumed that 65% of the overnight visits were at a hotel. Assuming one trip per skier therefore resulted in 4.4 million overnight lodging trips of 4.7 days each. This assumption may lead to an underestimation of the total number of overnight trips (a skier could have taken two trips of two days each rather than one trip for four days) and thus the solid waste and travel indicator values associated with skier visits.

Skier expenditures (including lodging and restaurant expenditures) from NSAA sources were based on resort revenues only. Therefore they do not capture any expenditures made away from the resort. However, the expenditure method is not used in the final determination of the environmental indicator values for this subsector. Final numbers for environmental impacts associated with lodging and restaurants were generated from participation data (Method I).

Estimates/Assumptions

An estimate is made on the average meals per person-day. A meal includes any purchase at a fast-food or a full-service restaurant, even if only for a cup of coffee. For overnight trips, it was assumed that three meals a day are purchased, while day trips only included two meals.

The travel distances for skiing were based on average travel time per roundtrip and percent traveling by air and automobile as reported by NSOS. First, an assumption was made that the average car and plane travel time are the same. Second, estimates were made on the average speed of cars (48.6 mph) and planes (450mph) to determine the distance traveled. The estimated average automobile speed is based on the EPA MOBILE5 air emissions model. The estimate for average air speed was taken from the *FAA Statistical Handbook of Aviation*.

Water use for snowmaking by ski areas was estimated using three different methods. Method 1 utilizes values for water use per acre of snowmaking for three ski areas in

different regions of the U.S. (Northeast, Rockies, and west coast) and extrapolated these values to the total acres of snowmaking in each region (obtained from NSAA surveys) and then to the U.S. The other two methods are both based on conversations between Bob Sachs at EPA's Office of Policy and Snow Engineering Inc. in Littleton, New Hampshire. Method 2 simply assumes 1,000,000 gallons of water are used per acre of snowmaking per year. This value is reportedly used in the snowmaking industry for rough estimates of water use. Method 3 utilizes regional-specific estimates of snowmaking coverage required per year (one complete coverage per year in the west; 3 complete coverages per year in the east; and 5 complete coverages per year in the mid-Atlantic). These values were then extrapolated to the total number of snowmaking acres in each region and then to the entire U.S. An assumption was made that the midwest region required the same snow coverage as the northeast (3 coverages per year). All three methods generated similar results. Method 3 resulted in the middle value and was used as the basis for the model.

Energy use by ski areas was based on data from NSAA's economics survey in which members were asked about their energy costs for snowmaking and lift operations. Based on information provided by snowmaking equipment manufacturers and consultants, estimates were made for the portion of energy derived from diesel-powered engines versus electrically from the grid. Next, average costs for diesel fuel and electric power obtained from DOE were used to quantify total kilowatt-hours and Btus of diesel.

Air emissions from snowmaking equipment were estimated from the gallons of diesel used and emissions factors for diesel boilers from EPA's *AP-42*.

Golfing Subsector Data

Data Sources

The primary data sources for the golfing subsector were obtained form the National Golf Foundation (NGF). *Golf Travel in the US* provided numbers for participation and travel behavior. *Operating and Financial Performance Profiles* developed by NGF for various types of golf courses were used to determine water use and revenue information for all U.S. golf courses. Total retail expenditures were available from NGF *Golf Consumer Spending in the U.S.* The *1997 Travel Market Report* published by TIA, provided information on travel distance and type of transportation used.

Data Qualifications

The NGF *Golf Travel in the US* provided information on three types of golfers: the golfer, the vacation golf traveler, and the business golf traveler. "Golfers" represent all US golfers who have golfed at least one round in the previous one year period. Vacation and business golf travelers are those participants who traveled on vacation or business and played at least one round of golf while on a trip (one round of golf is 18 holes). For each type of golfer the report provides: average rounds per year, average number of trips per year, average rounds played on trips, and average days on a trip. This information was used to analyze the participation and travel behavior of each type of golfer separately.

The *1997 Travel Market Report* uses the TIA definition of a trip which is characterized by travel of 50 miles or more one-way or that involves an overnight stay. The report describes travel characteristics for several types of travelers: business, pleasure, and vacation. Based on the definitions for these different categories, travel characteristic data for pleasure travelers were used for vacation golf travelers and travel characteristic data for business travelers were used for business golf travelers.

In order to capture only those lodging days and travel miles associated with golf on overnight trips that may have included numerous recreational and business activities, only a portion of the total trip days and miles traveled were attributed to golfing. First, it was assumed that only one round of golf is played a day to provide some indication of the number of days associated with golf. While many people may play more than a single round, others may play less than a full round in a day (nine holes). Therefore, "golf days" are equivalent to "golf rounds." For example, if a business golf traveler spent an average of 22.6 days on all trips in a year, having only played 4.9 rounds of golf on those trips, the total lodging days associated with golf is 4.9 days. Similarly, rather than associate the full travel distance with a trip that was made for both business and to play golf, only 22% (4.9/22.6) of the travel is attributed to the golfing subsector. The same method was used for vacation golf travelers.

Total expenditures on golfing were not available. The NGF facility profiles provided numbers for total revenue for all US golf courses, as well as breakdowns for the percentage of those revenues from food sales and merchandise. Total hotel and restaurant expenditures were calculated based on the participation data and average costs for hotel rooms and meals. Total retail expenditures was available from NGF *Golf Consumer Spending in the U.S.* The totals for hotel, restaurant, and retail expenditures were added to the golf facility revenue total. From this figure, food and merchandise at the golf facility were subtracted to provide total U.S. golf expenditures.

Final environmental indicator values for lodging and restaurants were generated from participation data (Method I) for the golfing subsector.

Assumptions/Estimates

It was assumed that only one round of golf is played a day to provide some indication of the number of days associated with golf. While many people may play more than a single round, others may play less than a full round in a day (nine holes).

It was assumed that the average meals per person was three per day for overnight trips and one per day for day trips.

For day travelers, it was assumed that the average round-trip distance to the golf course would be approximately 20 miles.

Fishing and Hunting Subsectors Data

Data Sources

Data for both the hunting and fishing sectors were obtained from the *1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* developed by both the Fish and Wildlife Service and the Bureau of the Census. These survey data include information for anglers and hunters on total trips, total days, and activity expenditures. Additional information on travel distance was found in the *1991 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*.

Data Qualifications

The 1996 survey provides total trips and total days for each activity. The difference between total trips and total days was used to obtain the total lodging days.

Retail expenditure data in the survey are broken into several categories of equipment. Any expenditures that could be associated with another sector (e.g., boating, camping equipment) were excluded.

Final environmental indicator values for lodging and restaurants were generated from expenditure data (Method II) for these subsectors.

Assumptions/Estimates

The 1991 survey provided the number of anglers or hunters traveling various ranges of distance from home, such as 25 to 49 miles. In order to estimate an average distance, the median of the range was used. Transportation for all trips was assumed to be a car except for those trips over 1,000 miles round trip (only 2%), which were assumed to be air travel.

Both subsectors have a relatively low ratio of total days to total trips. Therefore, overnight trips were assumed to be for one night.

Boating and Waterside Activities Subsectors Data

Data Sources

The primary data source for both the boating[10] and waterside subsectors is the *National Demand for Water Based Recreation* survey compiled by EPA. This survey includes a sample of 13,745 respondents from which data on participation, total trips, total days, average length of trip, average travel distances by transportation type, and lodging expenditures were available.

Other industry and technical sources were used for activity specific environmental data. Most notably, the reports *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling*; *Exhaust Emission Factors -- Spark-Ignition*; and *Nonroad Population Estimates* developed by the EPA Office of Air and Radiation were used to estimate boating emissions. Other sources included EPA Office of Policy, Planning and Evaluation's *Indicators of Environmental Impacts of Transportation* which was used to obtain Department of Transportation data on boating subsector waste generation. Also, the *Handbook of Environmental Engineering* was used for waste generation figures by the waterside recreation subsector, and wastewater data for boating were calculated from the report *Marinas and Small Craft Harbors*.

Expenditure data for the boating subsector also were derived from a number of industry sources. Total expenditures were drawn from TIA's *Tourism Works for America* report. Retail expenditures were based on the total sales of boats and boating equipment from the National Marine Manufacturers Association.

[10] 'Boating' refers to the use of small boats, such as motorboats, sailboats, canoes, rafts, etc. The boating subsector does not include cruise ships.

Data Qualifications

There is some concern for overlap or double-counting between the fishing and boating subsectors. Fishing and boating obviously often take place at the same time. However, the survey from which data was collected for the boating subsector asks respondents specifically to answer questions for "trips you took in the last 12 months for the primary purpose of boating." As fishing was also included as a separate activity in this survey, fishing impacts are not likely to be double-counted in the boating sector numbers. However, it is possible that fishing was a secondary purpose for some boating trips.

For both sectors, final environmental indicator values for lodging were generated from expenditure data (Method II), and values for restaurants were developed from participation data (Method I).

Estimates/Assumptions

The average meals per person-day for each subsector was assumed. For waterside activities, it was assumed that three meals per day are purchased on overnight trips, and two meals on day trips. For the boating subsector it was assumed that participants are likely to have less access to restaurants. It was assumed that two meals are purchased each day of an overnight trip, and one meal is purchased for day trips.

Information on waterside recreation expenditures was limited. Retail expenditures for waterside activities were estimated based on each participant spending ten dollars per year on waterside retail items (e.g., swimming suits and equipment, beach supplies, etc.). Lodging and restaurant expenditures were calculated using the average cost per meal and average cost per hotel room from industry organizations (National Hotel and Motel Association and National Restaurant Association). These values were combined to obtain a total expenditure figure for waterside activities.

Conferences and Conventions Subsector Data

Data Sources

Participation and travel data for conventions and conferences were obtained from the *1996 Survey of Business Travelers* published by TIA. The International Association of Convention and Business Centers (IACVB) Foundation *Convention Income Survey Report* provided information on the expenditures of participants in U.S. conventions.

Data Qualifications

The TIA travel data only consider those trips of 50 miles or more each way or trips that involve an overnight stay. Because some trips to conferences and conventions will undoubtedly be under 50 miles, the average automobile travel distances obtained from the TIA report will be somewhat higher than the actual value and automobile travel distances may therefore be somewhat overestimated for this subsector. It is not expected that the TIA data will affect airline travel appreciably because air travel under 50 miles is unlikely.

The IACVB report uses the "delegate" as its basis for expenditure numbers. A delegate is defined as an entire "personal travel party" attending a convention. IACVB measured the average delegate or "personal travel party" to equal 1.6 people. All statistics for delegates were adjusted to obtain data on actual participants.

Final environmental indicator values for lodging and restaurants were generated from expenditure data (Method II) for the conferences and conventions subsector.

Assumptions/Estimates

While providing an average distance traveled for all travelers, the travel information did not provide separate averages for air travel and automobile travel. It was necessary therefore to develop estimates of average distances traveled by air and by automobile based on the aggregated travel data. Estimates for air and automobile travel were obtained from a combination of two calculations. The first assumed that, on average, total automobile mileage is 8.27 times air mileage for an activity subsector participant. This average value was calculated using the same ratios from several travel reports developed by TIA, U.S. Department of Transportation, and EPA's National Demand for Water Based Recreation survey. The second calculation set the total mileage for all conference and convention trips equal to the sum of total automobile mileage and total air mileage. Total mileage was determined by multiplying total trips by the average mileage. Estimates for auto and air travel were determined by solving algebraically.

Average water use per convention participant was based on information obtained from *Wastewater Engineering* (Metcalf&Eddy,1991) for the average water use per seat in an assembly hall.

Electric energy use estimates were based on the U.S. Department of Energy's *Commercial Buildings Survey 1995.* This survey provides energy use for various types and sizes of commercial buildings. Conference and conventions space was

assumed to fall under the DOE category of "public assembly." It was also assumed that conference and convention buildings would typically be over 100,000 square feet in area. The DOE electric energy consumption rates, and number of buildings of this type and size in the U.S. were then used to calculate total energy use by conference and convention centers in the U.S.

Municipal waste generation for the subsector was determined using information from the *Handbook of Environmental Engineering*. An estimate for "visitor centers" waste generation per participant was used as a proxy for conference and convention centers.

Amusement/Theme Parks Subsector Data

Data Sources

The major source of data for the amusement/theme parks subsector was the *U.S. Amusement Industry Consumer Survey* published by the International Association of Amusement Parks and Attractions (IAAPA). The report contains information on participation, expenditures, and travel.

Data Qualifications

The basic unit used in the IAAPA survey is the household. Using values for the total number of households in the U.S. and the total U.S. population from the Bureau of Census, estimates were developed for total participation, average number of visits, average length of visit, miles traveled, and expenditures on amusement and theme park fees and other costs.

Two average expenditure figures were used to obtain the average total expenditures for amusement/theme parks: "total amount spent per visit - entrance fees/ticket fees" and "total amount spent per visit - other". These averages were multiplied by the total visits and added to develop a total expenditures figure for amusement parks. No further information was available on the breakdown of the "other expenditures." It is possible that "other expenditures" does not include expenditures outside of the amusement/theme park possibly resulting in an underestimation of total expenditures for this subsector. However, expenditure data were not used in the final determination of environmental indicator values for lodging and restaurants.

Final environmental indicator values for lodging and restaurants were generated using participation data (Method I) for this subsector.

Assumptions/Estimates

The average number of meals per person per day at amusement and theme parks was assumed. For overnight trips it was assumed that three meals per day are purchased, and for day trips it was assumed that two meals were purchased.

The average length of stay was estimated from IAAPA survey data. The IAAPA provides survey data on the number of visits per time length category (e.g., 25-48 hours). We examined the actual question asked of the survey respondents to obtain these data and determined that the wording was somewhat ambiguous. Some respondents may have interpreted the length of time spent at the amusement facility to be the total time away from home and others may have interpreted it to mean the actual time spent inside the facility. For times given under 24 hours, we assumed the participants were on day trips. For the time length categories between 24 and 48 hours we assumed an overnight stay. For the time length categories over 48 hours we assumed a two night (three day) visit. This last assumption may underestimate the lodging and restaurant indicator values as some travelers may have stayed longer than three days on average.

The same method as described above for the conferences and conventions subsector was used to estimate average mileage for air and automobile travel for the amusement/theme park subsector.

Water use data for amusement and theme parks was not available. Water use estimates were based on an average water use provided by *Wastewater Engineering* (Metcalf & Eddy,1991) for "picnic parks with flush toilets."

Energy use for amusement/theme parks was generated from numbers obtained for Universal Studios in Florida from EPA's Energy Star Buildings Program. Based on their total use and annual attendance, an average per person was developed and applied to the subsector.

Average municipal waste generation for the subsector was developed from waste generation data and attendance at Hershey Park in Pennsylvania.

Museums and Historical Places Subsector Data

Data Sources

The primary data source for the museums and historical places subsector was the *Profile of Travelers who Participate in Historic and Cultural Activities* by TIA. In addition, the *U.S. Amusement Industry Consumer Survey* contained information on average distances traveled for "historical attractions."

Data Qualifications

Participants in the museums and historical places subsector who travel typically participate in multiple activities per trip. Museums and historical places are just one of numerous activities in which people participate while traveling. On average, travelers who engaged in museums and historical places activities participated in a total of 2.7 different activities per trip. Therefore, not all lodging days, meals, travel distances, and expenditures were attributed to museums and historical places activities. For total days, lodging days, travel, and expenditures, 37% (1/2.7) was counted towards the museums and historical places subsector.

Final environmental indicator values for lodging and restaurants were generated from participation data (Method I) for this subsector.

Assumptions/Estimates

Assumptions were made on the average meals per person-day. For overnight trips, it was assumed that three meals per day are purchased, and for day trips it was assumed that two meals per day are purchased.

The same method as described for the conferences and conventions subsector was used for this sector to estimate average mileage for air travel and automobile travel from total travel mileage.

Water use for the museums and historical places subsector was based on the average use for "visitor centers" provided by *Wastewater Engineering* (Metcalf&Eddy,1991). Waste generation for the subsector was based on data for visitor centers obtained from the *Handbook of Environmental Engineering*.

Casino Gambling Subsector Data

Data Sources

Data for the casino gambling subsector was primarily obtained from the *Profile of Travelers Who Participate in Gambling* by TIA. In addition, participation rates for gambling were available through *Harrah's Survey of Casino Visitation*. Average travel distances were obtained form the TIA *1997 Travel Market Report*.

Data Qualifications

Similar to the museums and historical places subsector, a certain percentage of gamblers reported multiple activities on trips. Therefore for those gamblers who travel, only a portion of their travel days, lodging days, and travel distances were attributed to the casino gambling subsector (43% based on gambling being one of 2.3 activities).

Final environmental indicator values for lodging and restaurants were generated from participation data (Method I) for the casino gaming subsector.

Assumptions/Estimates

Assumptions were made on the average meals per person-day. For overnight trips, it was assumed that three meals per day are purchased, and for day trips it was assumed that two meals per day are purchased.

While the TIA data only included those gamblers who traveled 50 miles or more or stayed overnight, the Harrah's survey included all visitations to casinos. The difference between the Harrah's survey total number of trips and the total from TIA minus those who reported no overnight stay were treated as the day trip population. The average round trip distance traveled for day trips was estimated to be 100 miles.

Data on water use at casinos were not available. An assumption was made that casino gamblers, on average, consume three gallons of water per day.

The estimate of electric energy use by casinos was based on information obtained from EPA's Green Lights Program for an unnamed casino in New Jersey. This information was extrapolated to all of New Jersey based on information on the number, size, and attendance of casinos in New Jersey obtained from the New Jersey Casino Control Commission. Based on the attendance at New Jersey casinos, a per person electric energy estimate was developed and extrapolated to the entire country. Land use

information was calculated in a similar manner based on square footage information provided by the New Jersey Casino Control Commission.