Chapter 1

Non-market values of coastal recreation in California

Introduction

California has the largest ocean economy in the United States, and tourism and coastal recreation is the largest sector of California's ocean economy (See Figure 1.1) (Kildow and Colgan 2005). It is estimated that there are 150 million beach visits per year in California that generate economic impacts that could exceed $14 billion (King 1999) and net economic benefits that could substantially exceed $2 billion (Pendleton and Kildow 2006). Despite the importance of coastal recreation, relatively little is known about how people use the coast or how coastal management decisions impact coastal recreation. Over the last decade there has been an increased effort to better understand the behavior and economics of coastal recreation (Pendleton and Kildow 2006).

As reported in California's Ocean Economy (Kildow and Colgan 2005), the dominant sector of the ocean economy in California is the combination of tourism and recreation. Tourism often represents visitors from out of state, whereas recreation is most often day use. Tourism and recreation are obviously linked, but calculating the economic value for tourism and recreation require very different economic techniques. Tourism has a market value that is usually measured as gross revenues associated with coastal tourism-based expenditures. The gross revenues, and the jobs and taxes they support, are described in economic literature as economic impacts. The full economic value of coastal and ocean recreation, however, is not fully captured in the market because these activities are typically accessed without charge (with the exception of parking) (Kildow and Colgan 2005). These "non-market" values are the net value added to society that are generated by coastal and ocean recreation. From the perspective of the coastal user, the economic value associated with the use of a public resource is often referred to as consumer surplus.

Non-market values are not captured by standard economic measurements of impact and as a result, information on the non-market value of coastal recreation is often not available to policy makers. Failure to capture non-market values in the decision making process implicitly gives them a value of zero (NRC 2004). Omitting non-market values can lead to management decisions that are biased toward market-based values and without consideration of impacts to coastal uses that are highly valued, although poorly measured, by society. These decisions are often detrimental to the coastal environment and coastal recreation.

There are a number of examples from California for which the inclusion of non-market values in the coastal decision making process could have affected the outcome of local coastal development. In 1966, a harbor was constructed in Dana Point as an economic development project that destroyed a rich nearshore reef ecosystem and a popular surfing area known as Killer Dana. There is no information to suggest that the values associated with the lost recreational fishing, diving or surfing were explicitly considered when this decision was made. The market values associated with development of the harbor were understood but the non-market value of the negative impact to the coastal environment and recreation were likely given a zero value.

Presently in California, seawall construction is permitted to protect the market value of private homes, even in cases where the seawall will narrow or eliminate the public beach. In most circumstances, the non-market values associated with reduced beach recreation are not explicitly considered or mitigated. Fully informed coastal management decision-making that balances development with environmental and recreational protection must include non-market values.

Economic valuation provides an important tool to estimate economic values associated with coastal recreation so that explicit economic tradeoffs can be considered when coastal development impacts recreation or so that mitigation for impacts can be assigned (Turner, Pearce et al. 1993). The estimation of non-market values of coastal recreation provides decision makers with a common metric (economic values) to compare alternatives. Without non-market valuation estimates for coastal recreation, decision makers are left comparing the well understood market value of coastal development with a vague moral value associated with coastal recreation. Without understanding how coastal development impacts the economic values associated with coastal recreation, decision makers risk upsetting the balance between environmental protection, coastal recreation and tourism, and economic development. Effective decision-making requires sound estimates of the economics of coastal uses, data about recreational uses to describe who coastal users are, where and how they use the coast, and how their use generates economic impacts and economic values.

Background and significance

Regulatory protection of coastal and ocean recreation in California

The primary law that regulates coastal zone management decisions along the California coast is the California Coastal Act (CCA). Passed in 1976, two of the primary goals of the CCA are to "Assure orderly, balanced utilization and conservation of coastal zone resources taking into account the social and economic needs of the people of the state" and to "Maximize public access to and along the coast and maximize public recreational opportunities in the coastal zone consistent with sound resources conservation principles and constitutionally protected rights of private property owners (CCA, §30001.5)." Further, the CCA prioritized the protection of water-oriented activities, "Coastal areas suited for water-oriented recreational activities that cannot readily be provided at inland water areas shall be protected for such uses (CCA, §30220)."

The California Coastal Act charges the California Coastal Commission with the decision-making authority to uphold the regulations created to meet these goals. The CCA requires a permit for all development in the coastal zone throughout the state. Coastal development projects must meet requirements in the CCA designed to limit impacts to the coastal environment and recreational activities in this environment.

The CCA anticipated cases where coastal development may cause unavoidable impacts to the coastal environment or coastal recreation. The CCA defined a mechanism for resolution of policy conflicts. "The Legislature further finds and recognizes that conflicts may occur between one or more policies of the division. The Legislature therefore declares that in carrying out the provisions of this division such conflicts be resolved in a manner which on balance is the most protective of significant coastal resources (CCA, §30007.5)." To determine the most protective balance the Coastal Commissioners require information about coastal resources, including coastal recreation. Economic valuation studies provide a tool to compare how a resolution of conflicting policies will affect coastal recreation.

In some, but not all cases, the CCA requires mitigation of impacts. A clear example is when construction alters natural shoreline processes. The CCA states, "Revetments, breakwaters, groins, harbor channels, seawalls, cliff retaining walls, and other such construction that alters natural shoreline processes shall be permitted when required to serve coastal-dependent uses or to protect existing structures or public beaches in danger from erosion, and when designed to eliminate or mitigate adverse impacts on local shoreline sand supply (emphasis added) (CCA, §30325)." The California Coastal Commission can also require mitigation for other types of projects. The California Coastal Act does not contain a definition of mitigation. The Coastal Commission uses the California Environmental Quality Act (CEQA) definition of mitigation (CCC 1997). The Coastal Commission has applied mitigation measures in an *ad hoc* fashion for loss of recreational resources and other beach ecosystem services. There are two ways that the Coastal Commission has required mitigation for the impacts of shoreline protective devices. In some cases, a fee has been assessed to compensate for beach sand impounded behind a seawall that otherwise would have eroded to form the beach. This fee is calculated using engineering and geological information on bluff erosion and sand content (CCC 1997). In at least four cases, the Coastal Commission has required a mitigation fee for the loss of beach recreation. In these cases, the Coastal Commission has attempted to estimate the non-market value associated with lost recreation during the lifetime of the structure and assessed an in-lieu mitigation fee upon permitting the structure.

Environmental valuation

Environmental valuation is a collection of statistical methods based on economic theory that economists use to measure human preferences and assess the economic value of market and non-market goods associated with natural resources and ecosystem services. Economic value is a measure of the maximum amount an individual is willing to forego to obtain some good, service, or state of the world (Haab and McConnell 2002). In a market economy, currency (dollars in the United States) is the typical measure of the amount someone is willing to give up to obtain a good, service of state of the world. This is commonly called the willingness-to-pay. Welfare economics presumes that when the price of a good increases, an individual will consume less (See Figure 1.2). Comparison of price to willingness-to-pay creates a demand curve for the good. Consumer surplus is a measure of the economic benefit to the individual – the difference between the maximum willingness to pay revealed by the demand curve and the price actually paid for the good. Producers of goods also benefit in the form of profit, known as producer surplus. Producer surplus is the return to the producer over and above the cost of supplying a good. A supply curve defines the price at which the producer will supply a certain quantity of goods. The intersection of the demand curve with the supply curve will define the maximum combined consumer and producer surplus (See Figure 1.2).

When goods and services are traded in a market, such as coastal tourism, the market will define their values. Conceptually, the same measure of benefits applies to non-market goods. Since non-market goods, such as a beach, are typically not produced, measures of non-market benefits are concerned only with estimates of consumer demand and consumer surplus (See Figure 1.2) (Lipton, Wellman et al. 1995)

Economic values of coastal recreation

Coastal recreation generates two important economic contributions to the coastal economy; economic impacts and non-market consumer and producer surplus. Economic impact describes the flow of money through an economy and the associated jobs, wages, salaries and taxes associated with these flows. Included in economic impacts are the expenditures by visitors to the coast, who spend money locally on food, beverages, parking, and coastal recreational activities. These expenditures represent expenditure that may have been made elsewhere in the state (e.g., gas and auto), but are mostly expenditures that would not have been made in the absence of a recreational trip (Pendleton and Kildow 2005). Economic value, in contrast, is the net value added to society that the resource provides. From the perspective of the coastal user, economic value often is the non-market consumer surplus associated with the use of a resource. Profit is the non-market value from the perspective of a coastal business. Together these measures (consumer surplus and profit) are the total non-market use value.

Total economic value

The total economic value (TEV) model provides a framework for valuing ecosystem services. The TEV framework is based on the presumption that individuals have multiple values for ecosystems and provide a framework to ensure that components of that value are not missed or double counted (NRC 2004). The TEV framework separates ecosystem services into direct and indirect use values and considers non-use values (Figure 1.3). Use value refers to those values associated with current or future (potential) use of an environmental resource by an individual. The use can either be consumptive (e.g. recreational fishing) or non-consumptive (e.g. surfing or beach going). Direct use values can be measured using revealed and stated preference approaches. Indirect uses are more challenging to measure and often require models that link direct-use commodities with services (NRC 2004). Production function approaches seek to determine how changes in ecosystem services affect an economic activity, then measure the impact of the change on economic activity (NRC 2004). An example of this is linking loss of sandy beach prey resources to lower biodiversity of shore birds, and then to the change in consumer surplus to bird watchers.

Option and bequest values describe the value of preserving the option for use of services in the future either by an individual (option value) or by future generations (bequest values). The primary non-use value is existence value. Existence value is unrelated to the use of the resource and represents the willingness to pay for the resource to exist (e.g., willingness to pay for the protection of a beach you will never visit). Non-use valuation requires contingent valuation methods (NRC 2004).

Ecosystem services

Efforts to define and value ecosystem services go back several decades (Loomis, Paula et al. 2000). Ecosystem services are the benefits people obtain from ecosystems. The full definition of ecosystem services provided by the Millennium Ecosystem Assessment (MA) project (2005) is:

> Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as regulation of floods, drought, land degradation, and disease; supporting services such as soil formation and nutrient cycling; and cultural services such as recreational, spiritual, religious and other nonmaterial benefits (MA 2005).

The ecosystem services model is anthropocentric by definition, but the MA makes clear that sound ecosystem management must include the intrinsic values of ecosystems. Intrinsic values cannot be given a monetary value and instead require a values-based decision making structure (MA 2005). Ecosystem services can be valued using both supply and demand-based methods. Supply based methods include service-for-service methods, such as those used in Habitat Equivalency Analysis. These values are derived from replacement cost of the resource. Demand based methods are based on the TEV model and require estimating non-market values, typically expressed as consumer surplus (Hampton and Zafonte 2002).

Valuation methods

Estimating market values generated by coastal recreation and tourism is limited only by capturing information about business finances or spending by coastal users. Once this information is collected, calculating their expenditures requires only accounting. Unlike marketed goods and services, recreational activities often occur without the explicit exchange of money so they require different methods of measurement. There are a variety of methods to capture non-market values associated with coastal recreation. They fall into two primary categories: revealed preference and stated preference methods. Revealed preference methods seek to identify underlying preferences based on choices the user reveals in their patterns of consuming natural resources or in the consumption of marketed resources that are associated with the use of that resource. For example, a user's willingness to spend time and money to drive to a site that provides a particular coastal amenity reveals a minimum value for the use of the resource. Stated preference methods use survey instruments to gauge a users willingness-to-pay based on their response to questions designed to elicit a value for a resource. Stated preference methods are often used to gauge the value of a hypothetical or proposed change in a resource (Haab and McConnell 2002).

Contingent valuation

The contingent valuation method (CVM) is a stated preference method. CVM is designed to recover information about preferences or willingness-to-pay using direct questions. CVM usually takes the form of a survey questionnaire. CVM can be used to value a hypothetical future condition. For example, Bhat (2003) used CVM to estimate the non-market recreational benefits from snorkeling and diving associated with improved reef health in a proposed marine reserve. In some cases CVM is the only means of estimating willingness-to-pay. CVM is also the only way to measure the value of passive uses. Passive uses entail no direct involvement with the natural resource. Passive use values were used to assess the settlement for damages from the Exxon Valdez oil spill in Alaska and for the DDT released into the ocean off of Palos Verdes, CA (Carson, Hanemann et al. 1994; Carson, Mitchell et al. 2001).

CVM is highly sensitive to the survey instrument and method of asking the questions. CVM has been controversial because it relies on hypothetical situations and personal preferences, but resource economists have accepted CVM as a reliable method for environmental valuation (Haab and McConnell 2002). The National Ocean and Atmospheric Administration (NOAA) has established guidelines for best practices to create consistency across CVM studies (Arrow, Solow et al. 1993). Chapman and Hanemann (2001) argue that current studies using contingent valuation to estimate values for California beach visits are unreliable because the surveys are not site specific and fail to account for variation in travel cost to beaches throughout the state.

Travel cost method

The travel cost method (TCM) is a revealed preference method. TCM is based on the premise that visitors reveal their willingness-to-pay to visit a site through travel time and costs. The TCM was first suggested in the late 1940s by Harold Hotelling as a means of valuing public lands. Since that time TCM has become a popular method for estimating non-market values for recreation, appearing in thousands of academic journal articles (Haab and McConnell 2002).

TCM studies can be divided into single site models and multiple site models. The single site TCM creates a demand function by observing that visitors who live farther away from a desired location will incur higher travel and time costs to make a visit and will visit less frequently (Parsons 2003). Comparison of the number of trips taken across varying travel costs creates a demand function for a specific site. The demand function can be used to determine the benefit derived for each visitor, known as the consumer surplus (See Figure 1.4). Multiplying the average consumer surplus value by the annual number of visits shows the total recreational value derived for a site.

Single site models are best used to assess the total use value of a site that has few substitutes. Single site methods are less powerful when used to measure how environmental change will affect the value of a site or if a site has many alternatives.

A widely used multiple site model is the Random Utility Model (RUM). A RUM models visitors' discrete choices of sites from a set of multiple possible sites. Site choice is dependent of the characteristics of the site. The choice of sites reveals how visitors values different site characteristics by examining how they trade off additional travel cost to gain more or less of an amenity. A RUM can be used to value an entire site or to value changes in environmental quality at one or more sites (Parsons 2001).

Benefit transfer method

The benefit transfer approach, more accurately called a value estimate transfer, seeks to apply existing value estimates and transfer them to a new site. Conducting original valuation research is time consuming and expensive. Benefit transfers are commonly used in cases where there is neither time nor funding to perform a site-specific valuation study. It is generally agreed that benefit transfers are a "second-best" valuation method (NRC 2004). Benefits transfer methods are becoming increasingly common, but there is currently little consensus that benefits transfer methods are accurate or appropriate in many cases (Wilson and Hoehn 2006). Benefits transfer is limited by the quality of the original study and most studies do not provide enough detailed information on site characteristics or recreational uses to accurately adjust values to a new site (Wilson and Hoehn 2006). A conservative approach is to provide information on a the full range of values for a recreational activity based on the literature available and then estimate a range of values based on end points of the range found in the literature (Pendleton 2008).

Coastal recreation studies in California

The National Ocean Economics Program database lists 31 papers and reports on economic valuation of coastal recreation in California dating back to 1993. Research on beach going (including beach-related water quality studies) represents the largest portion of the research with 14 papers and reports (See Figure 1.5). The beach recreation papers can be divided into two groups, those reporting on economic impacts (market expenditures) and those reporting on non-market values, with some reporting on both.

Market values of California beach recreation

King (1999) estimated the fiscal impact of California beaches and found that beach visits generated $14 billion in direct revenue. Other studies have estimated the average expenditures per person per day trip ($/trip/person) for visits to California beaches. In a study of San Clemente beaches, King found that average beach related expenditures (including gas and automobile costs) were $54.79 per individual visit. A survey of beach goers in Southern California (Hanemann, Pendleton et al. 2002) found that per person per trip expenditures on beach related items and services were $23.19 for beach goers that took at least one trip in the summer of 2000. Nelsen, Pendleton, et al. (2007) surveyed surfers visiting Trestles Beach near San Clemente and found an average expenditure per trip to be $40.20 and estimated that visits to Trestles Beach produced an economic impact of between $8 million and $13 million to the City of San Clemente.

Non-market values of California beach recreation

Leeworthy and Wiley (1993) found that recreational use values for three Southern California beaches had annual non-market values of $360 million ($1993) and found average values per person per day trip to range from $12.19 to $77.61. Leeworthy (1995) estimated values of $85.39 and $90.58 ($2005) per person for San Onofre State Beach and San Diego beaches, respectively. Chapman and Hanneman (2001) estimated a consumer surplus value of $13 ($1990/trip/person) at Huntington Beach. Hanemann, Pendleton et al. (2004) conducted a intensive study of coastal recreation at 53 beaches in Orange and Los Angeles counties in California. Using a RUM, they estimated the net change in the economic values across all beach sites due to changes in either water quality or beach closures of different durations or at different sets of beaches. This study didn't estimate per person values for individual beach visits. Lew and Larson (2005) used a random utility model to estimate the value of recreation and specific amenities at 31 San Diego County beaches. They found an average value of $28.27 ($2005) per individual visit. They also found that the certain beach amenities including presence of lifeguards in towers, activity zones that separate swimmers from surfers, and free parking are important (statistically significant) to beach goers. Interestingly, their study found that water quality conditions are not a statistically significant factor in beach choice. Lew and

Larson (2005) did not aggregate their per trip per person value to a total annual value for San Diego County beaches because of the lack of availability and reliability of beach attendance data. Pendleton and Kildow (2006) created an aggregated estimate for the non-market value of all beach recreation in California through a two-step process. Using existing literature, they estimated the total number of annual beach visits and then used a benefits transfer approach to estimate a range for the average per person per trip value. They used a conservative estimate of 150 million annual beach visits and found that the non-market value of California beach visits ranges from $2.25 billion to $7.5 billion per year ($2005).

Economic values to mitigate for lost beach going and surfing

A common use for economic valuation is for natural resource damage assessments (most famously for the Exxon Valdez oil spill). As seen above, the literature provides a sound basis for determine values associated with beach recreation. However, when looking at a subset of beach recreation, such as surfing, it becomes more difficult to estimate appropriate values. For example, the Southern California Beach Valuation project (Hanemann, Pendleton et al. 2004) found that environmental degradation (poor water quality) resulted in substantially different non-market impacts for different types of beach goers. The study, however, did not look explicitly at different types of water activities, because the sample sizes were too small.

In California, there are two published cases that describe the use of economic valuation for the loss of surfing resources. Both cases use non-empirical and inadequate methods to determine the value of lost surfing because there is no literature or studies on non-market values associated with surfing. Oram and Valverde (1994) describe the methodology used by the Surfrider Foundation to argue for mitigation of lost surfing due to the construction of a large groin in El Segundo, California. By comparing a day of surfing to the entrance fee of a water park, the Surfrider Foundation estimated that the lost surf resulted in damages worth $244,000 to local surfers.

> Surfrider's analysis began with the cost of admission to Raging Waters, a commercial wavepool [*sic*] park located in Palm Springs, California. Multiplying the $16.95 admission fee for an adult "surfer" by fifty surfers per day equals $847.50 per day. Based on the history of the affected surf break, Surfrider estimated the break would offer good surfing conditions three days per week, six months out of each year (October to March). Since the break at El Segundo had been affected for approximately four years (1984-1988), Surfrider claimed a total of $244,080 in damages to surfing (Oram and Valverde 1994 p.12).

To assess the value of lost beach recreation from the *American Trader* oil spill in Huntington Beach, California, Chapman and Hanemann (2001) extensively surveyed beach users and used the TCM to value lost beach during the 34 day closure period. The economic valuation techniques were highly scrutinized and challenged throughout the legal case that ultimately awarded $18 million to the State of California for lost recreation. Although beach recreation was based on TCM methodology, surfing was valued based on a non-empirical approach. They estimated a per trip per person value using a similar approach to the El Segundo case (described above).

> While surfing is a specialized recreation activity which would generally be considered to have a higher unit value than general beach recreation - (see, for example, Walsh et al. (1998) - we knew of no valuation study that dealt specifically with surfing. We decided to use a unit value of $16.95 per surfing trip. This corresponded to the entrance fee at an inland water park in Southern California; the amount was suggested to us by an official of the Surfrider Foundation, who thought most surfers experienced a consumers' surplus at least equal to this, and it represented a premium of about 30% over our estimate of the unit value of general beach recreation (Chapman and Hanneman 2001 p.12).

With the addition of new data sources on the value of beach visits, Chapman and Hanemann (2001) refined their estimate value for a surfing day in Orange County.

> We believed that a different value should be used for surfing, since it is a more specialized activity that requires a higher degree of skill, knowledge and appreciation, and draws a very loyal following. Based on the travel cost literature, we believed that the consumers' surplus for surfing in Orange County was likely to be at least 25% higher than the consumers' surplus for general beach recreation, and we therefore used a value of $18.75/trip in 1990 dollars for surfing trips lost (Chapman and Hanneman 2001 p.13).

Lack of user data specific to surfing limited the accuracy of the per trip, per person value.

Chapman and Hanemann (2001) did make an effort to better understand what percentage of beach visits were represented by surfers. To capture surfers, they extended their survey to start at 6 a.m. and continue to 6 p.m. In doing so, they found that the percentage of beach visits that were for surfing ranged from 10-18%.

Statement of the problem and objectives

Coastal recreation in California is under threat. Increased coastal urbanization, declining water quality, sea level rise and shoreline armoring pose threats to California's beaches and surfing areas. A better understanding of the economic values of coastal recreation may even the playing field when decision are made that attempt to balance coastal development with protection of coastal resources, including recreation.

General studies on coastal recreation have been completed but they often fail to capture the diversity of coastal users, what natural and developed features attract them, or what environmental issues influence their choices. Without this kind of information, it is difficult if not impossible to fully understand how coastal zone management decisions will impact recreational use and the economic values associated with these uses.

Beach goers use the coast for a diversity of activities including walking, tidepooling, swimming, surfing, snorkeling and kite boarding. Compared to the large category of general beach goers, some specific activities have relatively small user groups and thus are hard to intercept via population-wide surveys (e.g., phone or mail surveys) or even on-site surveys. These users may make very specific decisions about their beach visits that are different from a basic beach visit and as a result, they way they respond to environmental change and the value they place on beach characteristics may differ from beach goers generally. For example, surfers may be more likely to avoid beaches with chronic water pollution issues. Tidepoolers may look for beaches with marine protected areas. SCUBA divers may desire parking close to the beach to facilitate transporting their heavy gear. Volleyball players will seek wide beaches with numerous volleyball courts.

Because the dominant use of beaches is "beach going," most studies have focused on this large group and assumed that their findings are representative for all coastal recreation. Most studies measure beach going generally and do not identify smaller subsets of people that may have very different behaviors and responses to coastal management decisions. In some cases entire users groups may be missed when assessing mitigation for impacts to coastal recreation. This can occur because the subset of users is too small to be captured in randomized phone surveys, or they use the coast differently than typical beach users (different times, locations and seasons) and are missed by on-site surveys. One possible solution to capture these smaller, hard to reach subsets of coastal users is through targeted Internet-based survey instruments.

Even when consumer surplus values are well studies in the academic literature, such a beach going in California, coastal zone managers are challenged by attempts to apply these values in decision making processes due to limited expertise, funding and permit timelines. As a result, the Coastal Commission has used an inconsistent and incomplete approach to mitigating for adverse impacts to surfing areas and local shoreline sand supply. The Coastal Commission has applied different methodologies for each project to determine the value of lost recreational use and has not consistently accounted for ecosystem service losses. As a result, mitigation fees are often subject to litigation, values for lost recreation are undervalued, and other ecosystem services values are not considered.

This dissertation seeks to assess the effectiveness of using Internet-based surveys to estimate non-market values for hard to survey coastal users in California and to review the use of non-market values of coastal recreation for decision making by the California Coastal Commission. This research will 1) apply an Internet-based survey to surfers to estimate the non-market value of surfing at Trestles Beach 2) evaluate the effectiveness of using an internet-based survey by reviewing the literature on internet-based survey instruments and comparing an Internet-based survey to an on-site intercept survey of surfers. Last, this dissertation will review the recent use of non-market values by the California Coastal Commission to mitigate for adverse effects from the construction of shoreline protective devices.

Objective 1: The Economic Value of Surfing: Use Internet-based surveys to capture difficult to reach recreational users to calculate non-market values of coastal uses.

Small or difficult to monitor groups of beach users that have unique interests, such as surfers, divers and kite boarders, represent a unique challenge to survey research. They are hard to identify in random samples of the population, their use has high spatial and temporal variability, and they may have a low response rate to in-person interviews (Shaw and Jakus 1996; Hanemann, Pendleton et al. 2004). Surfing is an example of this type of coastal recreation. Surfers may represent up to 20% of beach visits at certain beaches, but they are often underrepresented in beach going surveys (Chapman and Hanneman 2001). An Internet-based survey of surfers is used to estimate the non-market value of surfing at Trestles Beach. Surfers are representative of a hard to measure user group because their numbers are too small to capture by randomly sampling the population, they have a low response rate to on-site surveying, and they use the coast at times that are different than other beach goers.

Objective 2: Test the effectiveness of an Internet-based survey to estimate the economic impact and non-market consumer surplus values for surfing at Trestles.

Use of Internet-based survey instruments may facilitate responses from these hard to reach user groups. Internet-based surveys are becoming increasingly popular because of their ease of use and cost savings but they have known issues that limit the ability to generalize responses to a larger population (Couper 2000). Couper (2000) identifies sampling error, coverage error and non-response error as the major limitations to extrapolating results from Internet-based surveys to a larger population. As more households give up wired telephone service and exclusively use cellular phone service, telephone surveying faces similar challenges (Dillman, Smyth et al. 2009).

To improve our understanding of the potential biases for use of Internet-based surveys, we describe the benefits and limitations of Internet-based survey instruments and compare an internet-based survey to an onsite intercept survey.

Objective 3: Mitigating the adverse impacts of shoreline armoring on California beaches

The Coastal Act was written to ensure balanced utilization of coastal zone resources taking into account the social and economics needs of the people of the state and to maximize public access and recreational opportunities (CCA, §30001.5). The act specifies that water oriented activities shall be protected (CCA, §30220) and that in cases where impacts to coastal recreation those should be mitigated (For example CCA, §30325). In some cases the mitigation is through project design and in other cases the mitigation is monetary. To date, mitigation through monetary compensation has been applied in an *ad hoc* fashion and the CCA does not provide a framework or guidance for establishing mitigation values. Attempts to mitigate impacts to coastal recreation through monetary compensation have resulted in litigation. The Coastal Commission would benefit from a consistent approach for assessing mitigation fees. The objective of Chapter 4 is to provide conceptual models for supply and demand based approaches for mitigating for adverse impacts on local shoreline sand supply, discuss their strengths and limitations, review the use of non-market values to estimate lost coastal recreation, show through comparative analysis of past projects (case studies) how the Coastal Commission approaches have either over or underestimated the value of lost beaches, and provide recommendations for a consistent, more accurate approach based on accepted practices in the literature.

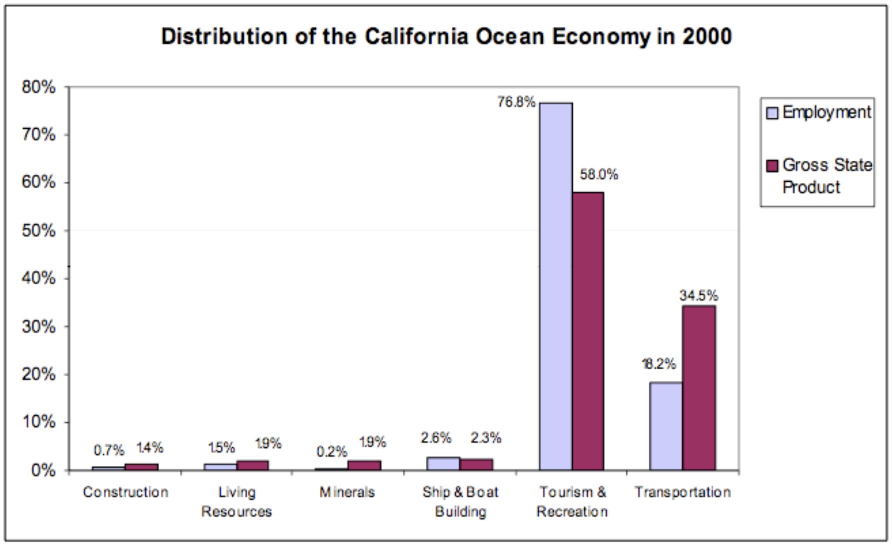

Figure 1.1 Distribution of California ocean economy in 2000 (Kildow and Colgan 2005).

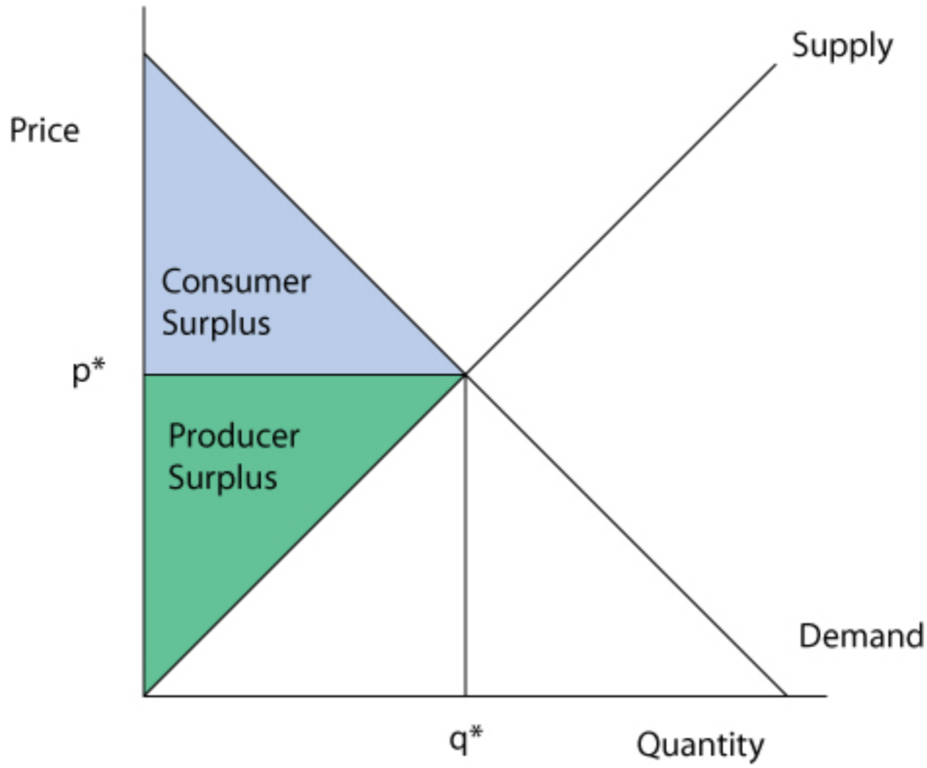

Figure 1.2 Consumer and producer surplus show the equilibrium point at q* and p*.

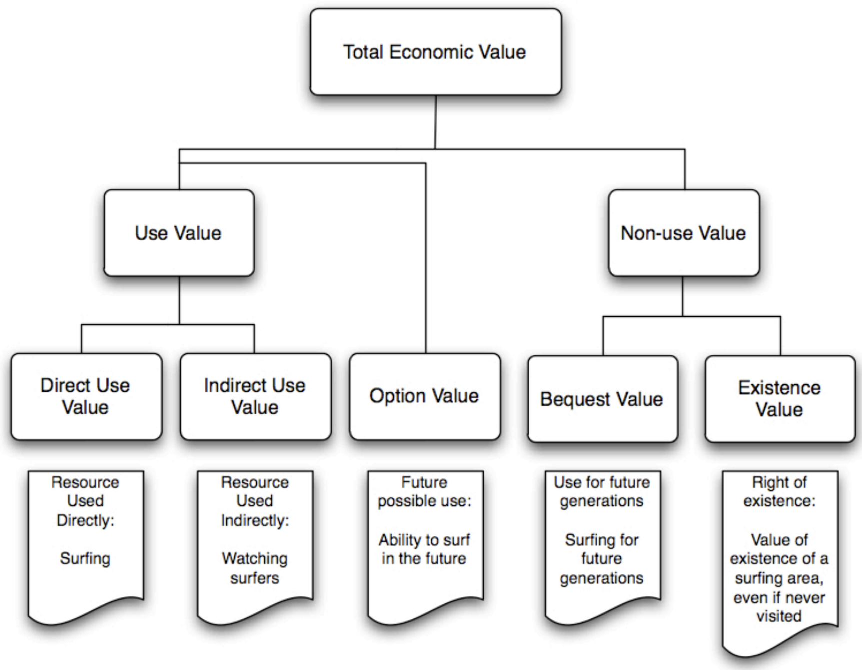

Figure 1.3 The total economic value of ecosystem services with examples for surfing (based on Freeman 1993).

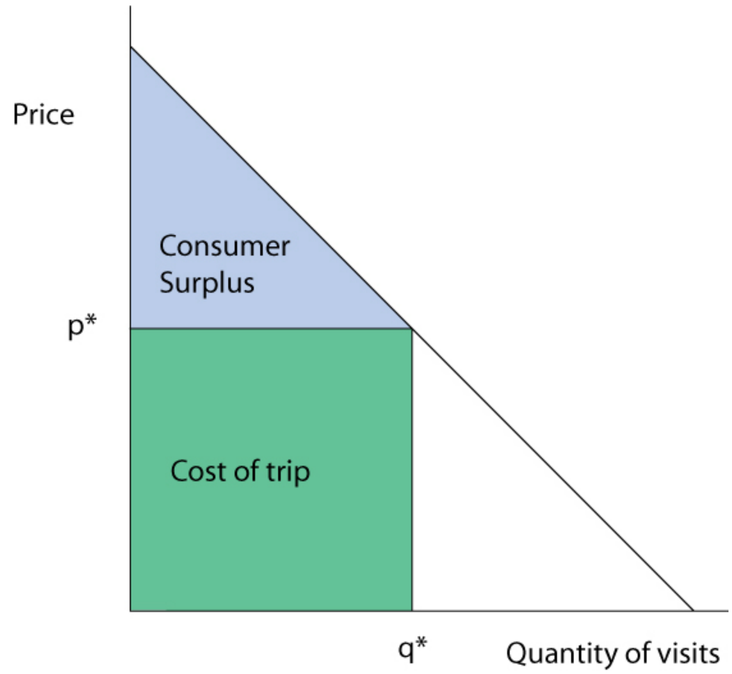

Figure 1.4 Recreational demand curve with consumer surplus.

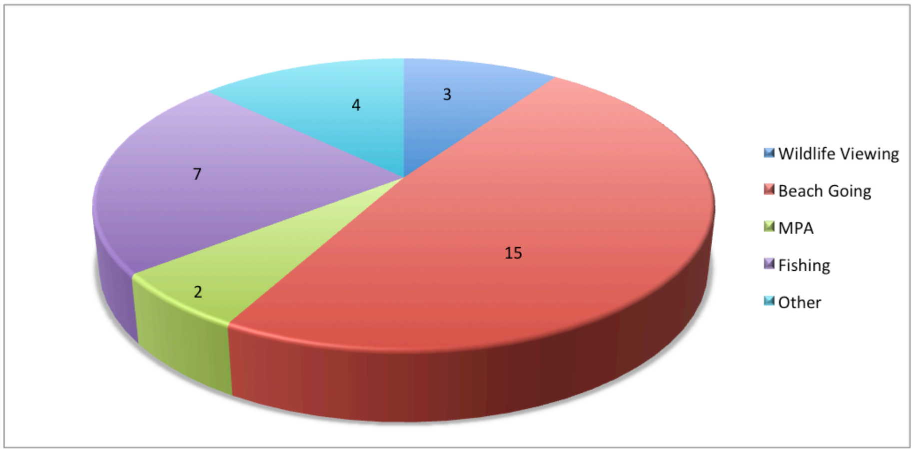

Figure 1.5 Number of economic valuation papers on California coastal recreation from the National Ocean Economics Program database.

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