Economics of the Intracoastal Waterway in Broward County, Florida

David Letson*

Introduction: the ICW as a Scarce Resource

Managing use of the intracoastal waterway (ICW) in Broward County is, in part, an economic problem. Without a hierarchy of ICW uses, policy makers cannot know what to do when conflicts arise. Two of the more visible ICW conflicts have pitted boaters against manatees, and port authorities intent on dredging against their federal permitting authorities. If natural resources like the ICW were available for everyone in any quantity, there would be no economic problem. We could all have what we want, without having to choose. Since we must choose, we should consider economic choices. Difficulties arise, however, since natural resource values are sometimes hard to measure and omitted from consideration. This paper considers who uses the ICW, why we have user conflicts, and how economics might contribute to resolving these conflicts.

Growth Implies More Usage of the ICW

The first step toward an economic understanding of the ICW is to consider its economic uses. There are several, for the ICW is a crowded place. The original motivation for inland navigation in the U.S. was national security: our founding fathers wanted protected navigable waterways so that military and merchant ships would

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Dr. David Letson is an assistant professor in the Division of Marine Affairs of the University of Miami's Rosenstiel School of Marine and Atmospheric Science, 4600 Rickenbacker Causeway, Miami, Florida 33149-1098.

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not have to be offshore during times of conflict. Our founding fathers could not have foreseen both the intensity and multiple uses of the ICW. The population of Florida's 35 coastal counties grew from 3.8 million in 1960 to 10.1 million in 1990 (UF/Bureau of Economic and Business Research 1996.). Growth has brought more users and more numerous and competing uses. Today barge traffic competes with recreationists for space, while manatees have to watch out for both. Unfortunately, we in Florida still have much to learn about how to grow economically without degrading our physical environment.

Congestion on the ICW is a reflection of the state's population growth and has led to physical environmental degradation. Broward County in particular has grown in population. In 1950 it had 83,900 inhabitants, in 1960, 620,100 in 1970, 1,018,300 in 1980, 1,255,500 in 1990, and 1,364,200 in 1995 (UF/Bureau of Economic and Business Research 1996.) In addition, Broward has nearly 90,000 seasonal residents, and more than 3,000,000 annual visitors. In 1993, marine services accounted for 16,610 jobs and $245 million in earnings. (Ernst and Young 1995) Today the marine industry is an important part of Broward's as well as the state's economy, but its growth has raised tensions among different marine interests. Until the economic values of all potential uses become important in the computation of progress and we make use of them in economic decisions, crowding on the ICW will persist and likely worsen.

Uses and Conflicts

Economic uses of the ICW are well known. Broward County reported 43,200 registered boats in fiscal 1993/94, the third highest (5.9%) in the state. Ft. Lauderdale alone has approximately 17,000 registered vessels. Boat and marine manufacturing and services are the city's third largest industry, producing several hundred million dollars in annual income. Lining the ICW in Fort Lauderdale are marinas, yacht services, sailmakers, boatyards, sales organizations, dinghy manufacturers, and marine supply stores. Recreational boating and ancillary activities are a major contributor to Broward County's economy. Gross marine sales were $683 million in 1994, 30% of the state total. A 1995 study commissioned by the Broward Economic Development Council estimated the total economic impact of the recreational marine industry to be 88,000 jobs; $1.5 billion in income; and $4.3 billion in output (Ernst and Young 1995).

Florida waterways also have much commercial traffic. At mile 1066, the straight deep inlet of Port Everglades has emerged as a

major ship terminal, handling millions of tons of ocean cargo a year, and is the world's second largest cruise-ship port. The nearby Port of Miami is the number-one cruise port in the world and the seventh-busiest container port in the United States. More than a third of the 4.5 million cruise vacations taken by North Americans in 1996 originated in Miami, and in that year the seaport handled nearly 6 million tons of containerized and rolling cargo from four continents (American Association of Port Authorities 1996).

Florida is attractive to the shipping industry because of its proximity to foreign markets and waterways, and port business is a big part of the state's economy. In 1993 ports handled more than 92 million tons of cargo, and international trade contributed more than $40 billion to the state economy. Ports (including trade and cruise activity) and port-dependent businesses create over 300,000 jobs and generate $600 million in state and local tax revenues (AAPA 1996).

The ICW has spawned many user conflicts. One of the most important is the dispute over dredging. According to the federal EPA each year about 400 million cubic yards of sediment are dredged and disposed of throughout the nation. Dredging is vital to the maintenance of waterways, but has become highly regulated, particularly when sediments contain toxins. Dredging and fill activities in Broward County require the issuance of a 5-year Environmental Resource License. The presence of wetlands doubles the license fee. In addition, another 200 % is added (40% over five years) for the Wetlands Resource staff to monitor mitigation constructed for environmental impacts. The county under these terms can collect fees of up to $15,000 on a single license. The total license fee including the 200% for monitoring must be paid prior to issuance of the license. Disposal of dredged sediments into surface waters also requires a federal permit. Section 404 of the Clean Water Act restricts the discharge of dredge and fill materials into U.S. waters, requiring permit approval from the U. S. Corp of Engineers. The Corp considers permit requests based on its own public interest review and EPA guidance on availability of alternatives and impact mitigation. EPA also has final veto power over the issuance of Section 404 permits.

In addition to the navigational use it offers to commercial and recreational watercraft, and its amenity use to residents and visitors, the ICW also provides a habitat for the manatee. The state and Broward County have imposed a complex set of speed restrictions and exclusionary zones along the canal to protect the manatee as

well as promote boating safety. These restrictions lower the economic value of recreational and transportation services the ICW provides. Research by the University of Miami's Boating Research Center estimated that a proposed county-line to county-line seasonal speed limit in the Broward ICW would reduce recreational boating trips in the county by 17% and revenues to the County's marine industries by $14 million. Despite the potential costs, the UM study found that 84% of those surveyed supported the speed limits (Baker *et al.* 1992).

The Manatee, A Forgotten User

The West Indian manatee is a large, plant-eating aquatic mammal found in shallow coastal waters, rivers, and springs of Florida. The Florida Department of Environmental Protection considers it highly endangered, and clearly the manatee suffers from the crowded conditions along the ICW. Common causes of injury, illness and death among manatees are boat/barge collisions, habitat loss, crushing and drowning in flood gates and canal locks, ingestion of fish hooks and monofilament, entanglement in crab trap lines and fishing trawl nets, and water pollution. Manatees are economically important because people value both their encounters with manatees and the knowledge that manatees exist.

The number of Florida manatees is unknown, but statewide aerial surveys at warm-water refuges in February 1996 by Florida Department of Environmental Protection counted 2639. This number is higher than previous estimates, probably because of improved survey methods and good weather during the survey. Manatees are notoriously hard to count because they tend to cluster at warm-water sources and areas with poor visibility. For this reason, researchers caution that the number of recovered carcasses alone may not be an indication of declining manatee populations (O'Shea *et al.* 1995). Increased numbers of boats on the water and of people living in coastal areas have probably boosted the probability of carcass discovery. Increasing deaths might simply be a result of stable mortality rates as applied to an increasing population.

1996 was a bad year for manatees, according to the Florida Department of Environmental Protection, which reported 415 deaths as compared to 201 in 1995. Some 151 died after contact with red tides, naturally occurring algal blooms that ordinarily stay far enough offshore not to bother manatees. In 1996 a combination of high winds, low rainfall and cool weather pushed the red tides closer

to the shore, into areas populated by the manatee. A byproduct of the red tides, brevetoxin, attacks the manatees nervous systems, rendering them unable to breathe. Even without red tides, though, 1996 would have been bad for manatees. A record high number, 60, were killed by boaters (Long 1997).

In May 1993 the Florida Department of Environmental Protection adopted a Boating Safety and Manatee Protection Plan, designed to reduce the number of accidents involving manatees and boats. Several governmental authorities enforce these regulations, and violators can be fined $500 and sentenced to six months in jail. Numerous signs have been posted along the canal enumerating the restrictions and where they apply (FIND 1995). Some restrictions are seasonal (Nov. 15-March 21); some are year-around; some are weekend only; some are for the full width of the water; and some have more restrictive limitations within a specified distance from the shore.

Since boats kill more manatees than any other cause, manatees are unlikely to recover in numbers without considerable accommodation with boaters. Collisions are so frequent that today most manatees in Florida have scars from being run over (Beck *et al.* 1982). Manatees have not learned to avoid areas where boat traffic is heavy, and are so cumbersome that they find it difficult to escape boats, particularly those that are speeding. Habitat loss is another navigation-related threat to the manatee. Many grassbeds have been reduced or eliminated by water pollution and dredging activity. Entanglement in or ingestion of fishing gear also kills manatees (Beusse *et al.* 1981; Forrester *et al.* 1975). Manatees need a high adult survival rate because they reproduce slowly. (O'Shea *et al.* 1985)

The extinction of the manatee has now become a statewide concern. This, despite the fact that the animal offers no conflict with fishermen, either commercial or recreational. No indigenous population depends upon them for survival, and they offer no threat to swimmers. In fact, they are regarded fondly by most Floridians and visitors, as evidenced by the large number of Manatee license plates purchased throughout the state. Many people are aware that extinction of the Florida manatee would set a poor example for developing countries under far more economic pressure to preserve habitat and wildlife. (Van Meter 1989) All these factors, however, have not given the manatee a reprieve from extinction within the state. Better management of the ICW would be easier if we had a clearer idea of the economic value of its many present and potential uses, including as a manatee habitat.

The ICW as a "Common Pool" Resource

The scarcity of resources in relation to human demands implies tradeoffs. In markets, we at least can make informed choices. Products are visible, have well-known characteristics and carry designated prices. While it spawns a great deal of economic activity, the various uses of ICW are not themselves transacted in markets. Registration fees for boaters, while not negligible, cover administrative costs and do not represent willingness to pay for boating access or the value of lost manatee habitat. Consequently, much less information exists about these alternative uses of the ICW. Posted prices are lacking that would reflect user values.

In part the absence of prices for ICW services is because the ICW is a common pool resource, similar to fishing. Common pool resources are said to be rival in consumption and non-excludable in provision. Both these features are crucial to understanding the economic nature of user conflicts. Rivalry means that when one person consumes a good it reduces the consumption of others. Rivalry of uses creates conflicts: e.g., boaters versus manatees. Non-excludability means that a resource owner cannot legally prevent anyone else from using it. Taken together, the rivalry and non-excludability features explain why markets do not develop for the ICW. Users are unlikely to pay for what they now can obtain without cost. Without a price to ration access, crowding and conflict will result.

While the working of the market may ensure that the world as a whole will not quickly run out of energy or food, it gives far less protection to resources not privately owned or that are treated as free, such as fish. Because use is free and rival, the common pool resource will tend to suffer more rapidly from over-use, especially when associated with places experiencing high population growth and/or rapid technological change. (The American bison is an example of a common pool resource that became over-exploited only after population growth and the introduction of the repeating rifle.)

The lack of markets for most common pool resources implies a lack of information for decision makers. We do not know as much as we would like about which uses of a fishery or the ICW are most important to protect. Yet if we are to make informed choices, we must know the economic values of what we are trading off.

Economic Valuation

While most agree that the ICW suffers from overuse, no such consensus exists on how we should limit access. This paper argues for the role of economics in identifying the most highly valued uses. The case for economic valuation is compelling to many but also has its critics.

Why measure economic value? After all some say that to place a value on manatees or the Grand Canyon, as if they were traded in markets, is to degrade them by removing their "not for sale" status (Kelman 1981). More generally, economics suffers from what economist Kenneth Boulding termed "its implied neglect of the heroic" in its depiction of human motivation as cost-benefit calculus:

> No one in his senses would want his daughter to marry an economic man, one who counted every cost and asked for every reward, was never afflicted with mad generosity or uncalculating love, and who never acted out of a sense of inner identity (Boulding 1969, p. 10).

For Boulding, economics can assess the inefficiencies of an ICW degraded by crowding but has little to say about any moral obligation we might feel regarding its use or condition. Clearly both our desire for practical gain and our sense of duty should motivate our concerns about natural resource degradation. Thus, despite its important role, economics alone should not dictate decisions regarding ICW access or any other natural resource management issue.

Economic evaluation should, however, play a role in policy making. First, as already mentioned, it can identify or at least approximate what the best choice may be. Second, it demonstrates the importance of previous efforts. An example of the latter occurred in 1987 when Dade County wanted to know if the artificial reef system that it had built for $1.4 million made economic sense. J. Walter Milon, professor of food and resource economics at the University of Florida, showed that enhanced recreational fishing from the reefs was worth $17.5 million (Milon 1987).

Choices involving unpriced goods are troubling for policy makers and for the public as well. How much do we value manatees as compared to boating access? To make comparisons involving unpriced goods we must impute the economic value in question. In markets we choose by comparing our willingness to pay with the price of a product. We decide to purchase when willingness to pay at least equals price. Economic valuation means finding some measure

of willingness to pay when markets fail to reveal that information directly.

Willingness to pay is a measure of an individuals' preference for the good in question. Because economic valuation measures the preferences of people, we say it is anthropomorphic; not included are intrinsic values, those unrelated to humans (values "in" things rather than "of" things). Economists do not dispute the importance of intrinsic values but are unable to measure them. Economic valuation is also better suited to smaller scale subjects, both temporally and spatially: what economists attempt to evaluate are people's preferences for changes in the state of the environment, rather than of the environment in its entirety (Pearce 1993). Another point of contention is that economists express valuations monetarily, for ease of comparison with other values. To some, this practice is immoral (Kelman 1981). To economists, it is merely convenient since people express their preferences monetarily for most other goods and services.

Economic values represent the individuals' willingness to pay either for benefits or to avoid costs. Usually, the values that count belong to those making the choice, that is, the current generation. A potential bias exists where the benefits of the choice might accrue to future generations, because future generations are not present to have their votes counted (inter-generational bias). Economic valuation focuses on the efficiency gains and losses of alternative resource uses, and unfortunately has much less to say about distributive effects within a time period or across time periods.

As an example of economic valuation, consider a coastal area that is degraded so that it supports a lower abundance of organisms than in the past. While an ecologist would consider the coastal area less valuable than before, that would be true in economic terms only if humans prefer non-polluted to polluted areas. That is often the case, but if in some instance no humans notice or care about the diminished ecological abundance, then there is no loss in economic value. (If people did not care about manatee preservation, it too would lack economic value.) The lost economic value from the degraded coastal area equals the maximum amount that individuals are willing to pay to have the area free of pollution.

Despite the controversy economic valuation frequently generates, some conservation groups have become proponents of its use. "Today it is obvious that economic activity and environmental well-being are linked and cannot be separated," said Sharon Newsome, National Wildlife Federation vice president for resour-

ces conservation. "We must understand all of the economic implications of an issue and base our own positions on the best economic information we can gather." (Quoted in Brandt 1993, p. 7.)

Types of Economic Value

The different uses of natural resources imply the range of values we assign to them. The total economic value of a natural resource asset like the ICW can be broken down into its component parts. *Active use values* include those associated with aesthetic appreciation as well as recreational and commercial navigation. *Passive use values* sometimes called existence values, are unrelated to any current or potential active use and derive simply from the knowledge that a resource exists in a given state. Even if a person were never to have sensory contact with the Grand Canyon, he or she might value the knowledge that this unique asset exists. Additional fees for Florida automobile tags with manatees on them may be interpreted as an expression of existence values since few of the people buying the tags are likely to see a manatee. *Option value* is that expressed for preserving a resource use alternative, and may be significant if alternative usage may change the resource irreversibly and if the resource in question possesses unique attributes or we lack secure substitutes for it. Even if we do not recognize a use for a species of plant today, we may be willing to pay for its preservation because it may prove valuable for medical science in the future. Total economic value is the sum of active and passive use values and option value (Pearce 1993).

How to Measure Economic Value

Methods for imputing economic values are numerous, as documented by a recent volume of applications to marine resources (Colgan 1995). With the *contingent valuation method (CV)*, surveys directly elicit respondents' willingness to pay, based on a hypothetical description of the good, available substitutes, and how it would be paid for. CV has been used to estimate economic values for preserving endangered species, such as the bald eagle. In the bald eagle study (Boyle and Bishop 1987), respondents were asked if they would accept a membership fee to join an organization that would save the bald eagle, which was stated in the survey as being near extinction. The main advantage of CV is its flexibility, since unlike other methods it does not rely on observable economic behavior to deduce values. The hypothetical nature of CV enabled it

to be used for damage assessment following the Exxon Valdez oil spill in Prince William Sound, Alaska, but was open to criticism, since the survey respondents were asked to react to hypothetical rather than real events.

Researchers who use the *hedonic price method* compare property prices (or wage rates) to impute values for such attributes as air quality or noise (or in the case of wages, the value of workplace safety). For example, if two houses are otherwise similar, except that the first is located next to a hazardous waste site, the higher value of the second house will reflect the disamenity of the waste site. One notable application of the hedonic price method used in coastal zone research assessed the damages of PCBs to property values near New Bedford Harbor in Massachusetts (Mendelsohn et al. 1992).

Using the *travel cost method*, researchers can calculate the economic costs (time, expenditures) necessary to reach recreational sites as an estimate of willingness to pay for recreation. In effect, these travel expenses represent the "price" of the recreational experience, and are an indirect but observable indicator of user value. By comparing the number of visits to alternative sites, economists are able to impute economic value to site attributes, such as improved water quality. In 1990, Frederick Bell and Robert Leeworthy of Florida State University used a travel cost approach to assess the economic value of a Florida beach day ($203/day for tourists and $286/day for residents; Bell and Leeworthy 1990).

Lastly, economists also have developed the *averting expenditure method*. For example, if residents of a city respond to groundwater impairment by purchasing a filter or bottled water, then summing these averting expenditures (for bottled water) provides an estimate of their willingness to pay to avoid contamination.

The choice of which method to use depends partly on (1) which uses are to be valued (e.g., existence values can only be estimated with the contingent valuation method), (2) who will use the economic valuation (e.g., courts of law tend to favor estimates derived from observable behavior, as with the hedonic price, travel cost and averting expenditure methods), and (3) the availability of relevant, observable market information.

History of Economic Valuation and Legislative Mandates

Historically, values that are difficult to measure have often been ignored in the natural resources policy process. The use of economic valuation in natural resources policy has evolved with both economic

science and our appreciation of the resources at stake. Previously, even when decision-makers were aware of the physical harm or benefit that a policy might have on natural resources, available economic tools did not enable quantification of the effects. Today economic theory can better address natural resource valuation, and federal laws and regulations in some cases stipulate that such valuations must be made (Lipton et al. 1995).

Economic valuation of natural resources gained its first statutory authority with *The River and Harbor Act of 1902*, which required engineers to review the costs and benefits to commerce of proposed Army Corps of Engineers' projects. With time, the idea that federal projects should have economic justification gained support. *The Flood Control Act of 1936* authorized federal participation where the benefits of flood control exceeded costs. Cost-benefit analysis spread to other agencies as a way to justify public works and determine who should pay for them. After World War II, federal agencies broadened their scope to include indirect benefits and costs, as well as intangibles.

The environmental movement brought significant federal commitments to pollution control in the *Clean Air Act of 1970* and the *Clean Water Act of 1972*. Both statutes, however, explicitly prohibited comparisons of costs and benefits, basing effluent standards solely on public health criteria. Because of budget constraints, however, economics continued to play an important if implicit role.

Economic valuation of natural resources has grown significantly in importance since the early 1980s. President Reagan's Executive Order 12291 of 1981 requires cabinet-level departments to prepare benefit-cost analyses to justify major projects. These analyses are then sent to the Office of Management and Budget's Office of Information and Regulatory Affairs for review.

More importantly, environmental legislation has explicitly called for economic valuation of natural resource damages. The *Comprehensive Environmental Response, Compensation and Liability Act of 1980* (CERCLA or Superfund) gave citizens the right to sue for natural resource damages resulting from hazardous waste disposal that contaminates public resources, such as rivers, lakes, estuaries, or other aquatic or terrestrial resources. CERCLA's natural resource damage assessment provision explicitly calls for estimates of lost values from injured resources.

Under CERCLA, compensation for contamination from hazardous waste disposal must make the public as well off as it would have been without the contamination. Resource trustees must determine lost resource values prior to restoration. Values may include

those that society associates with the knowledge that a natural wilderness area exists (i.e., existence values). Regulations promulgated under authority of these statutes specifically discuss methods for measuring damages, including travel cost, hedonic valuation and contingent valuation, as well as the range of types of values (e.g., market-related, non-market use values, etc.). The opportunity has never seemed closer for comprehensive assessment of economic values for natural resources policy.

Conclusions

Natural resource values are sometimes difficult to measure but that hardly means we have nothing to lose. Economic considerations will remain important for the future ICW, as demands we place on it grow. User conflicts occur because excluding users is difficult, uses are rival because not all economic values can be easily quantified for inclusion into the policy process. In those instances economic valuation can help decision makers set priorities because no resource use, including preservation, is free. For wise use of the ICW, we must think clearly about all of the economic values at stake.

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