WASHINGTON SEA GRANT

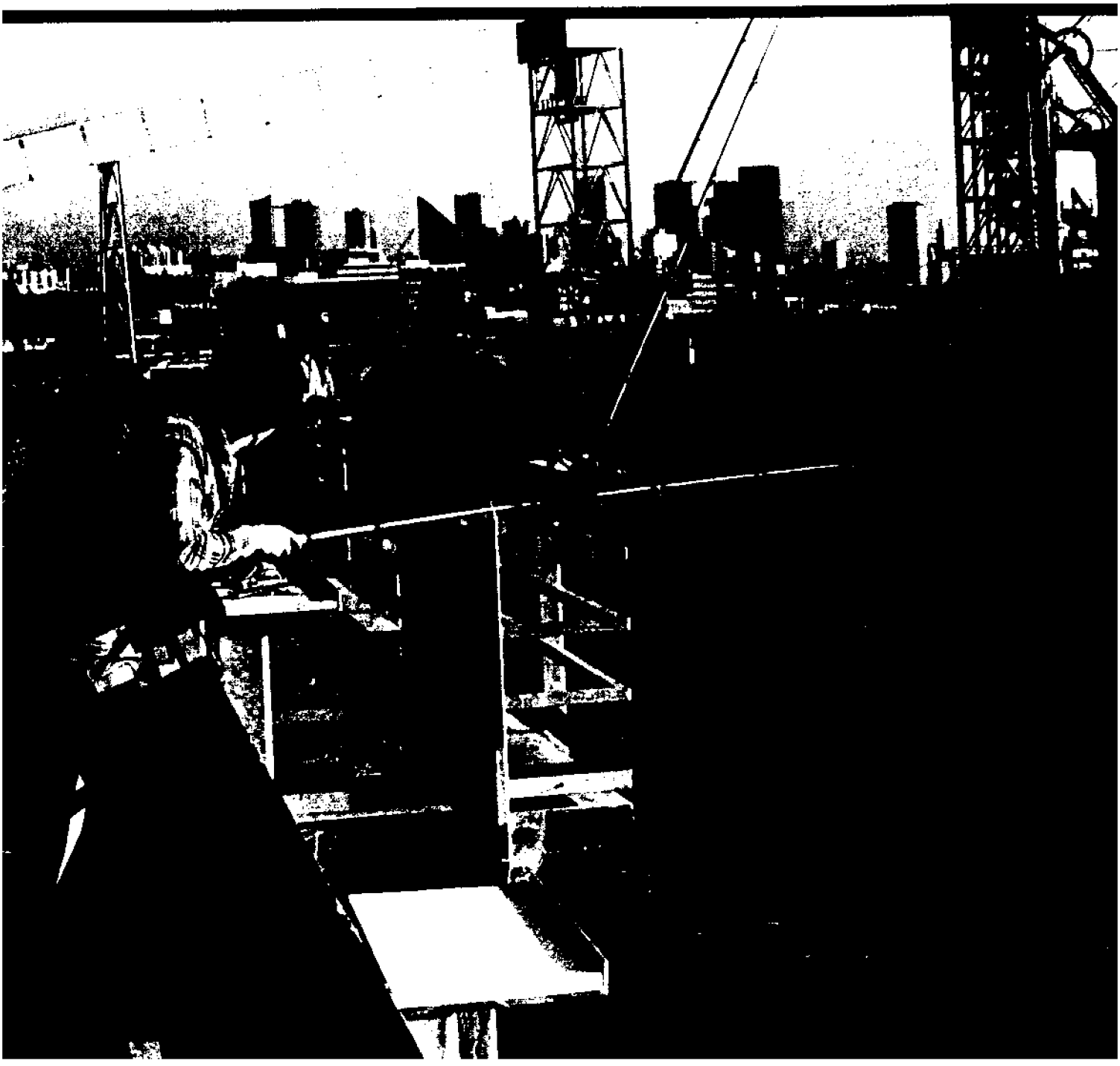
TECHNICAL REPORT

FISHING PIERS

Their Design, Operation, and Use

Raymond M. Buckley and James M. Walton

WSG 81-1 February 1981



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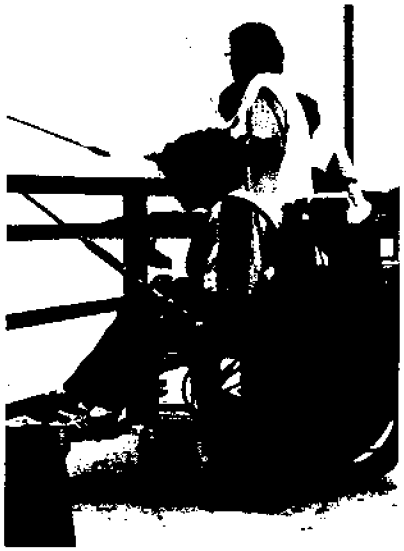
Introduction

The desire to improve nearshore recreational fishing opportunities for anglers along the Atlantic, Gulf, and Pacific coasts of the United States is evident from the numerous fishing piers providing access to the marine environment. Any fishing pier that provides access to fishable waters is a success, to a degree, but some piers offering access to the same fishery as other nearby piers are more successful in attracting anglers. These piers evidently fulfill the needs and desires of their patrons to a greater extent.

Differences in the structural design of a pier and in the physical and operational amenities offered can help determine the fishing success and enjoyment anglers realize during an outing. These differences in piers are often controlled by environmental conditions, by monetary constraints, and by varying management philosophies. However, one factor creating these differences--and one that is usually overlooked--is a lack of communication among local recreational fishery managers, angling experts, pier designers, pier owners, and pier operators. Even the most basic amenities benefiting anglers are omitted on many piers because of this failure to exchange information, rather than because of monetary or design constraints.

Failure to consider the specific management needs of the concentrated, intense recreational fisheries created by fishing piers can adversely affect a pier fishery. In most areas, fishing piers have been included under the general recreational fishery management regulations governing catches by boat and shore anglers. Bag limits, size limits, and gear restrictions for boat and shore fisheries are normally based on the population dynamics and biological considerations of target species in a broad region. For many species these generalized regulations are too liberal to sustain a harvest from a fishing pier. Resource management strategies for fishing piers should take into account the population dynamics of the resident and semiresident species of fish in the pier area. In some situations, the closure of a significant area surrounding the pier to all other fishing increases the possibilities for a sustained harvest for pier anglers.

Active management of a pier fishery can also be combined with passive management through facility design. The number of anglers can be limited by total available space. On large facilities, the area for each angler can be allocated by "functional boundaries," such as rod-holder spacing. Underwater reef enhancement materials can be placed so that only a portion of the fish population can be reached by pier anglers, or they can be designed in such a way that



only those fish migrating from a reef complex beyond casting range to structures placed under the pier can be harvested.

The development of a comprehensive fishing pier management strategy, encompassing such divergent concerns as structural designs, angler desires, and fishery harvest rates, is a relatively new concept in fisheries management. The Washington Department of Fisheries is making a substantial investment in establishing a number of public recreational piers with habitat enhancement structures to provide shoreline anglers in metropolitan areas with access to marine resources. The success of this program will depend upon the fisheries' providing sustained harvest levels under heavy angling pressure and the facilities' meeting the needs of anglers through functional designs in pier construction and amenities. Information and ideas on meeting these requirements were obtained by a survey of fishing pier facilities in Florida, California, Texas, and Washington.

California, Florida, and Texas have been actively involved in this form of recreational fishery enhancement for many years. Furthermore, these areas offer the advantage of having fishing piers that were established under different goals and management strategies. In Florida and Texas, for example, many of the fishing piers are supported and managed by local municipalities and private concerns. These facilities demonstrate a spectrum of management strategies that attempt to maximize angler participation and revenue. In California and Washington, on the other hand, most of the fishing piers are free public facilities. Unlike California, the state of Washington has developed a site-specific regulatory ability.

Compilation and analysis of this survey have guided the Washington Department of Fisheries in the development of its own fishing pier program and resource management strategy. However, the information should also prove valuable to other government agencies to develop or update their programs, and to pier developers and operators desiring to maximize angler satisfaction on each fishing pier.

Description of Areas Surveyed

Florida

The survey in Florida began at Sebastian Inlet on the Atlantic Coast, approximately 10 to 15 miles north of Vero Beach. Ten ocean fishing structures (see map, page 5) were examined during September 1979 between this central portion of the state and the extreme southern end of the peninsula, at Miami.

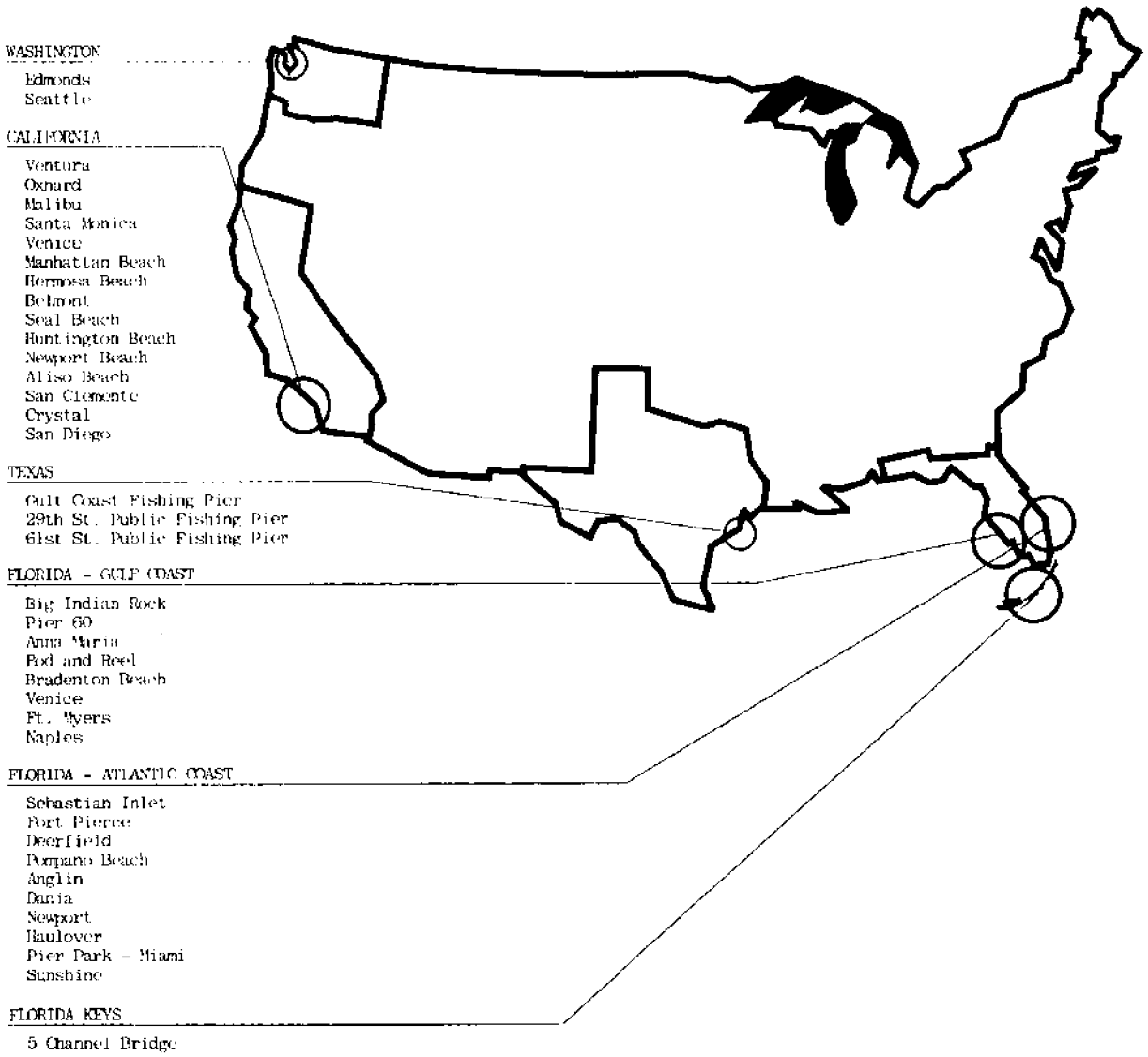
"The mainland along this section is bordered by long, straight, narrow barrier islands behind which are narrow lagoons. Although many of these lagoons were formerly unconnected, they have been made continuous by construction of the Intracoastal, or Inland, Waterway. This waterway connects with the sea by narrow inlets which occur at intervals of a dozen miles or so" (Freeman and Walford, 1976). Many species of fish including drums, grunts, snappers, and mullet congregate near these inlets. Fishing facilities bordering them can be quite productive.

The Continental Shelf off southern Florida is narrower than it is anywhere else on the Eastern Seaboard. However, even at the shelf's closest proximity to the shore, fishing piers running over 1,000 feet seaward terminate on flat sand bottoms in 15 to 30 feet of water. This shallow-water fishery is heavily influenced by the seasonal abundance of migratory fish species, local weather conditions, proximity to inlets, and fluctuations in the Gulf Stream and other water masses.

The Florida Keys, at the southern end of the state, are linked by numerous bridges, many of which are equipped with walkways or catwalks that are also used as fishing platforms. Reef fishes and migratory pelagic species, varying in their seasonal abundance, are common in the catches around bridge abutments. In general, the bottom is very shallow, rarely extending below 10 feet.

Eight pier facilities were examined along the southwestern Florida Gulf Coast. The bottom topography in this area is characterized by wide expanses of flat sand, interrupted only by occasional jetties, inlets, and natural reefs. Bottom depths vary with location, but in general, depths exceeding 30 feet are only common 3 to 4 miles from shore. Fishing piers are located primarily in, or near, large metropolitan areas or parks, and they extend to maximum depths of 10 to 12 feet. As in many of the other shallow-water areas around the state, the majority of fish observed in the catch are migratory species, with seasonal abundance patterns influencing the fishing success rate. Local residents regularly frequent the piers; however, the majority of fishing activity occurs during peak tourist seasons.

Locations of piers surveyed



California

Fishing piers exist at intervals along the central and southern California coast from San Francisco to San Diego. Fifteen piers (see map, page 5) were examined during November 1979 in the southern portion of the state beginning at Imperial Beach, close to the Mexican border, and extending through the San Diego and Los Angeles metropolitan areas to Ventura, about 70 miles along the coast from Los Angeles.

This area is south of Point Conception, which is generally considered the dividing line between the southern warm-water fishes and northern cold-water species. Thus, it is not uncommon for these pier fisheries to include species of fish normally ranging farther north or south.

Most piers are on flat sand bottoms adjacent to broad beaches. The average depth at the end of the piers is 20 to 30 feet. Catches from these structures are significantly influenced by seasonal migrations of sport fish. Surfperch, California halibut, bonito, mackerel, croakers, smelt, and queenfish are the dominant fish in the catches on these piers (Pinkas et al., 1968).

The Hermosa Beach Fishing Pier habitat enhancement structures were examined under relatively calm sea conditions. This quarry rock reef, at a depth of 15 feet, consists of piles of rock spaced at intervals parallel to the pier and within easy casting distance of anglers.

Texas

A brief survey of three Gulf Coast fishing piers (see map, page 5) near Galveston, Texas, was conducted in March 1974. The bottom topography in this area is similar to that described for the southwestern Florida Gulf Coast, with the nearshore environment consisting of flat sand beaches and shallow-water depths extending well offshore. The fishing piers near Galveston are either independent structures extending directly from the shoreline, or extensions of short rock jetties constructed to retard beach erosion. At some locations, the rock jetties are capped with concrete or asphalt for access to shallow-water fishing.

The nearshore fishery along the Gulf is influenced by the seasonal abundance of migratory species. However, populations of resident and semiresident species also contribute to the fishery.

Washington

Several small fishing pier facilities exist along the Puget Sound shoreline in the state of Washington (see map, page 5). In March 1979 the Edmonds Public Fishing Pier, the first large structure built exclusively for fishing, was opened. This facility, the first in a series of piers planned for metropolitan areas, was constructed by the Department

of Fisheries and incorporates many of the amenities popular with pier fishermen in Texas. The Elliott Bay Public Fishing Pier in Seattle opened in January 1981. This second facility includes several design improvements making the pier more compatible with local recreational fishing techniques. These piers are positioned along the 30-foot bottom contour, but anglers casting from the pier can easily reach depths of 50 to 60 feet. Associated with the pier are extensive habitat enhancement structures that attract and support sizeable populations of fish.

Puget Sound is generally a deep-water marine habitat with daily tidal fluctuations of 10 to 14 feet. The nearshore areas in central and southern Puget Sound, where most of the piers are planned, are composed primarily of flat compacted sand, which hosts a limited number and variety of fishes. In rocky areas and on man-made enhancement structures, the diversity and number of fish species are greatly increased. Rockfish, cod, flatfish, and surfperch are resident and semiresident fish species that can be taken all year but that vary in abundance with the seasons. Salmon, hake, and sablefish are pelagic migratory species that are commonly caught from piers.

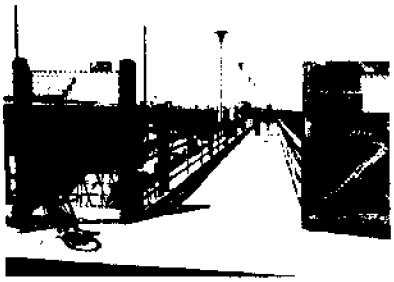
Survey Methods

The normal procedure used during the pier surveys was to examine the entire length of the pier, noting the physical design and the general arrangement of amenities on the pier. On those facilities operated by private concerns, an attempt was made to contact the owner or lessee of each pier. When this was not possible, as in the free access piers, individuals operating the pier concessions or adjacent fishing tackle stores were interviewed. Discussions focused on the operation of the pier, promotion techniques, the physical amenities offered, maintenance, and pier management responsibilities.

Contacts with fishermen on the piers included questions about their reasons for selecting particular piers and the fishing techniques they employed. The fishermen, their gear, their techniques, the pier amenities, and the piers themselves were photographed for documentation and later evaluation.

A variety of fishing piers were examined in the course of the survey. Many of the older structures had been converted from commercial operations to recreational fisheries use. The degree of conversion varied, prompting comparisons among piers and resulting in the following descriptions of the piers visited and comments on the physical designs of fishing piers in general.

Basic Pier Construction



Walkways

Most converted commercial piers have wide walkways and do not pose special access problems for visitors, including those in wheelchairs. Newer facilities designed specifically as fishing piers should have access walkways at least 8 feet wide to allow easy passage of wheelchairs or fishing gear carts moving in opposite directions. The slope of the walkway must also conform to wheelchair requirements. These considerations should be included when piers are being designed, especially if long walkways are being constructed to reach the main fishing areas. Fishing activities on access walkways can produce serious congestion problems and unsafe conditions for all patrons. The fishing width of the pier (16 feet minimum) should begin at the water depth where fishing activities normally take place. On facilities where this was not included in the design, access walkways that cross potential angling areas should be posted "no fishing," to assure safe passage.

Decking

The wooden decking on all facilities should be close-fitting to prevent the wheels on wheelchairs and the legs of anglers' chairs from dropping into the cracks. Concrete decks, commonly used on many of the newer structures, eliminate this problem. A fine-grained, rough finish on a deck will prevent it from becoming slippery when wet. Sand-impregnated paint works well for smooth wooden decks.

Location of structural amenities

The width of the deck will determine the location of structural amenities such as benches, light stanchions, and fish-cleaning stations. On narrow piers, these amenities should be placed along the center line so as not to inhibit anglers moving along the railing, and they should be spaced to allow both visitors and anglers easy movement across the pier. On wide piers, benches can be placed near the railings, but an open space of 5 to 10 feet should be left to provide ample room for movement along the railings. An added benefit of this design is that the benches form a natural walkway for visitors, keeping them from inadvertently interfering with anglers. It is advantageous to have the benches fastened securely to the deck to prevent them from being thrown over the side by vandals.

Fishing wells

Several piers have been designed with large openings in the deck to increase the railing space and to allow angling for fish directly under the pier. These "fishing wells" are often used to renovate a large commercial facility for use as a fishing pier. The openings can provide access to fish that are using the shadow of the pier to avoid direct sunlight and also to those fish feeding on organisms growing on the pilings or habitat enhancement structures under the pier. This design strategy is fine for small fish, but limits the chances of landing large fish that may swim around the pilings or away from the pier when hooked.

Railings

Minimum railing heights are set by federal and state laws. A height of 42 inches is appropriate for adults, but a minimum height of 36 inches benefits both young people and wheelchair anglers. In some situations, a standard 42-inch railing can be used, with sections of lowered railings incorporated into the design. Ten- to twelve-inch "bull rails," commonly observed on docks converted from commercial use to recreational use, are designed to stop equipment, but not people, from going over the edge. These rails are unsafe for recreational facilities.

Railings can also serve several purposes other than as safety barriers. They can be constructed of conduit to carry wiring or water for facilities on the pier. The railing top should be wooden and should be slanted slightly toward the pier deck. Wooden rails are warmer and more comfortable than other materials to lean against in cold weather, and the slanted top encourages fishermen to place articles (and themselves) on the deck rather than on the railings where they are more easily knocked overboard. Fishing rods leaning against a slanted rail are in less danger of breaking if a large fish suddenly takes the bait. The railing top should be wide enough to permit attachment of rod-holding devices as well as bait-cutting boards or other amenities.

Pilings

Wooden pilings treated with creosote or other chemicals are commonly used to support piers in marine waters. Although the initial costs may be less than for other materials, the need for replacement can be quite frequent, especially in areas where marine boring organisms are abundant. On some piers, concrete has been poured around existing wooden pilings to prevent attack from borers or to strengthen the structure. This method did not appear to be a long-term solution for the piers surveyed, however, because of the deterioration and sloughing-off of the concrete from the wooden piles.

Precast solid or hollow-core concrete pilings on the piers surveyed showed little if any deterioration. The use of concrete piles reduces the number of pilings required to support a pier, and the porous surface provides an especially suitable habitat for many encrusting food organisms that attract a variety of fish. When few pilings are used, the area under the pier is opened up so that anglers playing fish are less likely to wrap their lines around a piling and lose the fish.

There is a trade-off, however, when fewer pilings are used to support a fishing pier. In time, the layer of encrusting organisms will become quite thick and may hinder fishing by snagging terminal gear. Pilings are also high relief habitat enhancement structures attracting both pelagic and demersal species of fish. A general reduction in the number of pilings can reduce the attraction potential of the pier. All of these concerns can be compensated for, however, by the addition of properly designed alternate habitat enhancement structures under the pier.

Lights

Lights are important for night fishing. The optimum lighting conditions are those in which the light poles are inboard from the railing, yet tall enough or properly angled for direct light to reach the water close to the pier. With the light inboard from the railings, the railings are essentially barrier-free, allowing a fisherman playing a large fish to move along the pier without having to pass his pole around a light stanchion. Direct light attracts fish or increases the feeding periods of certain fish. This may be due to an attraction of the fish themselves or the organisms upon which the fish are feeding. In either case, the lights are beneficial to the pier fishery.

Lighting also undoubtedly helps prevent vandalism and crime, and of course it is a direct aid to those using the pier in the evening. In those instances in which piers can be seen from nearby residences, the lights do not have to be visually distracting at night. Overhead reflectors can be used to deflect the light down onto the pier and over the water. This makes the direct light almost impossible to observe from any angle above the pier.

Water

The availability of running fresh water is important on fishing piers. Unless an angler is using gear specifically designed for saltwater use, which is not usually the case on a pier or light tackle fishery, the corrosive qualities of salt water will quickly ruin rods, reels, and tackle. Either special faucets or those used in conjunction with fish-cleaning stations can be adapted for rinsing off gear. A short piece of flexible garden hose fitted to the faucet will permit anglers to maneuver the stream of water to the desired location. In climates where freezing can occur, at least one outlet should be warmed so that water is available throughout the year.

Important Pier Amenities

Regulation and information displays

The experience and expertise of fishing pier anglers are highly variable. Many are beginning fishermen who are unaware of what species they are catching or of the regulations pertaining to those species. Display boards with pictures of the most commonly caught species are very helpful, especially if the regulations governing the species are posted alongside. Such devices can be very useful in educating fishermen and, in turn, making fisheries regulations more effective.

Displays on catch utilization are also effective in helping anglers fillet or otherwise prepare their catch for later cooking. This information also serves to introduce anglers to the table value of some fish that might be discarded because of unfamiliarity with the species. There can be a positive effect on the management of a pier fishery by bringing underutilized fish into the harvest and thereby reducing some of the harvest pressure on more popular species.

Fish-cleaning stations

Several types of fish-cleaning stations were observed during the survey. The most popular had rectangular stainless steel or wooden sinks that slanted slightly toward a center hole for discharging fish offal. Other types included round or polygonal sinks with tops slanting to a common discharge. The incline should not be so great, however, that it is difficult to hold a fish in place while it is being cleaned. Fresh water was provided at most of the fish-cleaning stations for washing the catch; however a few had pumped seawater. The latter seems costly because of equipment corrosion, and it is unnecessary for fish-cleaning purposes.

At least one, if not all, of the stations should be designed to accommodate handicapped anglers. The clearance around the sink, the distance from the water faucets to the front of the sink, the clearance from the deck, and the sink height should all meet wheelchair requirements.

Offal is ordinarily discharged back into the water from the fish-cleaning stations. When this practice is limited to only those fish caught from the pier, it is not normally detrimental to the environment, and, in many cases, it actually benefits the fish and invertebrates living near the pier. Locating the cleaning stations over the deepest water available and spacing them as far apart as possible should minimize the chance of waste accumulating on the bottom or being washed up on shore.

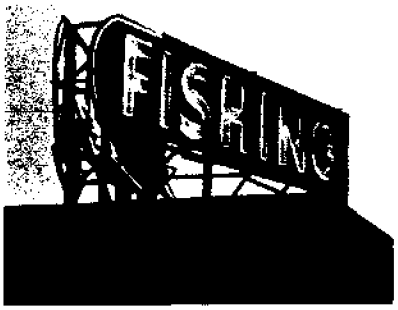
If shelters are provided over the cleaning stations, lighting inside them is an additional requirement for night fishing.

Benches

Wooden, steel, and concrete benches, as well as combinations of each, were observed on the piers surveyed. Benches with backs are preferable to those without, and wooden benches are warmer in cold weather than other types. On narrow piers, back-to-back benches on the center line maximize the available fishing area. Some should be shielded for use during extreme weather conditions.

Wind, rain, and sun screens

Among the most popular amenities are wind, rain, and sun screens that protect the angler during extreme weather conditions. The designs of these structures are variable, ranging all the way from simple corrugated sun shields that provide shade to elaborate gazebo-like units that house fish-cleaning stations on the inside and benches under an overhanging roof on the outside. One functional design utilizes a rain and wind shield of clear plastic. Benches and open spaces large enough to accommodate the normal wheelchair are provided inside these structures. Placement and design of shelters, however, should not interfere with access along the pier nor encumber large areas of the railing.



Concession facilities

Concession and restroom facilities allow piers to be self-contained operations and increase potential benefits. A concession facility should be located within easy access of the angler. Many of the older piers have their service building located on the pier itself--a convenient arrangement especially on long piers. Modern designs often require the services to be located on shore because of the high insurance and construction costs of building over water. If the facility is to be built on shore, either the service counter should face the pier or, at the very least, a window should open in that direction so that the attendant can watch activities on the pier.

Safety equipment

A telephone line placed on the pier can provide access to emergency services quickly. Life rings and "jacob's ladders" for aiding individuals falling into the water are helpful, but unfortunately these often get stolen. The addition of an alarm on such a device could serve two functions: it would alert everyone that there was someone in trouble or that someone was trying to steal the equipment. Such items could also be placed within the concession area. This increases the response time somewhat, but still makes the equipment available. On piers supported by large-diameter pilings, polypropylene line should run the length of each piling so that a nonswimmer in the water has something to hold on to. Overhand knots tied at 1-foot intervals between extreme high and low tide marks make good handholds and cover all necessary depths.

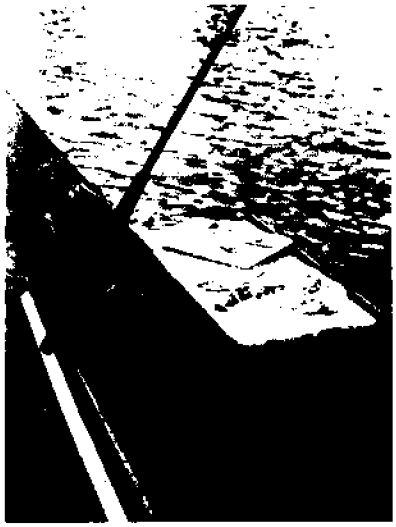
Parking and access

One of the greatest inducements to the use of a fishing pier is the proximity of adequate parking and public transportation. If it is necessary to locate parking at a considerable distance from the pier, then accommodations should be made to allow anglers to drop off gear close to the pier entrance. Some facilities provide tram service to and from the pier and on the pier itself. Public transportation can even be rerouted to offset inadequate parking.

Other Useful Amenities

Bait-cutting boards

In order to preserve the benches, railings, and deck, it is wise to place bait-cutting boards at convenient intervals (approximately 15 feet) along the pier. One of the easiest methods of accomplishing this is to build the boards on top of the railing. Some piers have cutting boards built inboard from the railing. This minimizes the chances of losing gear, but creates an obstacle to moving laterally along the pier when fishing. If there are size limits for frequently caught fish, a scale can be affixed to the bait boards as a convenient device for anglers.



Rod-holders

Rod-holders allow gear to be fished properly without being continuously held by the angler. They also secure the rod to the pier and prevent the gear from being pulled overboard by a fish. Rod-holders may be as simple as angled 2-inch-diameter holes drilled into the top railing so that the rods slant in a 30- to 60-degree direction outboard from the pier. Other designs use notches in the railing, or bolted-on rod-holders, or even holes cut into the deck. Rod-holders should be spaced about 3 to 4 feet apart to give individuals adequate fishing space and to maximize the use of the available railing. Proper spacing of rod-holders is one way of managing crowded conditions on a pier.

Rod- and gear-holding racks

Excess gear or unattended gear strewn across a fishing pier hinders the movement of anglers and results in broken rods, lures, and lost gear. Rod- and gear-holding racks placed at convenient locations on the pier alleviate this problem. These amenities allow anglers to place excess gear away from heavily traveled paths and out of their own way when they are fishing. Racks placed on the outside of a shelter wall are convenient and do not require additional deck space.

Live bait tanks

In many instances, fishing success can be improved by the use of live bait. Tanks with running seawater can be placed on the pier for individuals purchasing live bait from the concessionaire or capturing their own. Fiberglass-covered wooden troughs, plastic sinks, and large ceramic bowls have all proved effective for holding live bait.

Drinking fountains

On hot days, a drink from a conveniently located drinking fountain is a welcome relief. Drinking fountains should conform to handicapped requirements.

Telescopes

Nonessential amenities such as telescopes are appealing devices for the many fishing pier visitors. In areas with commercial vessel traffic or boat angling near shore, telescopes are frequently in use, as they are on hot, sunny days near popular beaches.

Pier Operation

Concessions

Anglers utilize fishing piers 24 hours a day, all year-round, except in areas with extreme winter weather conditions. Peak fishing activity normally occurs at daybreak and again at dusk. An early morning concession opening is a real convenience for most anglers, whereas in the evening, the concession can normally be closed shortly after dark after fishermen have purchased bait and tackle for the evening. Many operations remain open 24 hours a day, however, thus eliminating the need for a night watchman and providing additional sales.

Most concessionaires have copious supplies of tackle for rent and for sale. Profitable operations stock primarily those items that have a high turnover or that are required by fishermen. Pier fishermen are particularly innovative in their approach to angling, and the terminal tackle they use can be very diverse. Some of the more standard equipment and some of the innovative ideas are discussed in Appendix I. Many operators spend part of their slack time making their own terminal tackle to sell to customers. Piers may also offer rental storage racks or lockers for regular customers.

In most operations, frozen and fresh bait are offered for sale, and sometimes live bait as well. Great care must be taken to oxygenate the holding water, feed the bait, and cull out the dead bait. Live bait is very popular among fishermen, and in many cases, it is extremely effective for catching certain species of fish. The stocking of preferred baits often leads to supplementary sales of tackle and other gear.

Information and photo displays

Nothing entices anglers more than the possibility of encountering the big fish. Photo displays of large fish that have been caught from the pier, and even mounted trophies, will encourage expectant anglers to spend hours fishing and will bring them back again for the next big one. The individuals whose pictures are displayed are acknowledged as the experts, and their selection of the pier as a place to fish in turn promotes the pier.

Along with photos of big fish and successful anglers, information about individual species of fish can be presented to increase anglers' chances for success. The information should include the most likely time of catching the species, listing season, tide, time of day, and so on. It should also include special techniques, tackle, and baits, if appropriate.

Information bulletin boards are an effective means of communicating with visitors to the pier. In addition, they allow regular patrons to contact each other, to set up meetings, and, in a very real sense, to turn the pier into a social gathering place.

Contests and clinics

Daily, weekly, monthly or seasonal contests held by the concession operator entice people to fish as often as possible on the pier. Daily contests for groups of youngsters, the handicapped, or any other special interest groups introduce many nonfishermen to the sport and undoubtedly create many converts as well as being good publicity. The longer running contests help develop steady customers and a core of "old timers" who usually spend as much time helping and teaching others as they do fishing themselves. Some concession operators use these "resident angling experts" to conduct clinics on pier fishing methods. Such educational programs serve to keep anglers aware of current productive fishing techniques, and they also produce steady pier fishermen (and customers) for the facility.

Newspaper and radio spots

The constantly changing conditions of a pier fishery can generate interesting and informative news spots for newspapers and radio. Information on what fish are currently available, the catch of the week, the water and weather conditions, contest updates and results, and other bits of fishing news will keep the idea of pier fishing on the minds of potential anglers. The energy-efficiency of fishing piers, the low cost of participation, accessibility to public transportation, and the pleasant atmosphere can all be stressed.

Passes

On fishing piers that charge an entry fee, regular customers can be encouraged through the offering of multiple trip or season passes at reduced rates. Passes such as these can be awarded as prizes in fishing contests on the pier or donated as prizes for other contests in the community.

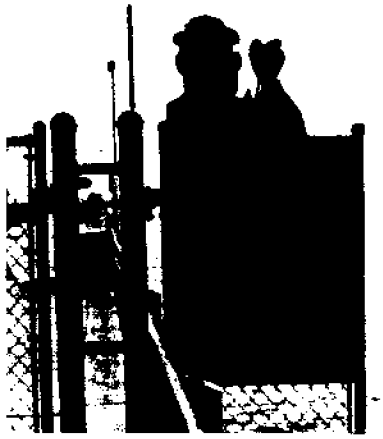
Maintenance

The safety of anglers using the pier should be of prime concern to both the owner and the operator. Within the operating agreement and budget for the facility, provision should be made for continuous maintenance and repair of the structure and its amenities. It is irrelevant who has the responsibility, although the operator is probably in a better position to react quickly to a dangerous situation.

When anglers interviewed during the survey were asked why they frequented a given pier over others in the area, a majority of them said that they preferred the cleanest and best-maintained facility. In areas where there was an obvious choice between clean and unkempt piers, the clean ones were the more heavily utilized. Of most concern to anglers were the simple washing down of the deck and fish-cleaning stations, and the removal of litter from the deck and trash containers. For many of the regular patrons, fishing excursions were social affairs, and they wanted to meet in clean surroundings.

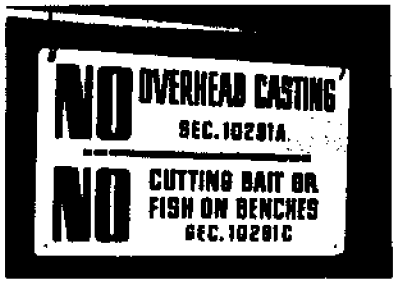
Personnel

The interaction between operating personnel and the pier clientele can determine the success or failure of a pier business. The successful operator knows his clientele, their fishing techniques, the gear they require, the bait they want, and the services they will use. If there are several piers in the area, the ones with the friendliest and most helpful personnel will receive the greatest use. Anglers may avoid facilities where the operator gives unreliable reports on recent fishing success or is indifferent to customer desires.



Pier capacity and fishing gear restrictions

Management of the people engaged in the fishery on a privately run pier is often controlled by the pier operator or by local ordinance. On a free access pier, any need for management of the clientele must be anticipated by the controlling agency and implemented through general use regulations. When a run of fish comes in close to the fishing pier and also during peak periods of the fishing season or on weekends, the railings can become crowded. At such times, operators often limit customers to one rod each to allow



everyone railing space to fish. If the end of the pier is more popular than other areas, this section can be declared "a one rod only" area, or it can be reserved for certain types of fishing activity by posting a notice or by issuing a special pass.

Certain fish, such as large sharks, can be hooked from the pier but not readily landed. When they swim around the pier, these fish can wreak havoc with anglers' gear. In some areas, shark fishing is prohibited, or the maximum size of the gear allowed on the pier is limited through restrictions on reel size and line strength. This allows the largest specimens to escape before causing serious problems.

Occasionally, the frenzy of fishing activity and the curiosity of onlookers combine to create a hazardous situation. When there is a large crowd and the fishermen are hurriedly casting and retrieving fish, onlookers can easily be injured by flying tackle. While it is the responsibility of the angler to avoid injuring other people, it is up to the discretion of the pier operator to limit entry onto the pier and prevent problems from occurring. Although difficult to enforce and in most situations unnecessary, a policy of "underhand casting only" can be instituted when conditions are congested.

Habitat Enhancement Structures

On Florida's Atlantic and Gulf coasts and on the Pacific Coast, marine habitat enhancement structures have proliferated and, to some extent, have been very successful. The most significant parameters governing their success seem to be the depth at which the structures are located, the height of the structures, and the type of material from which they are constructed. Shallow-water enhancement structures, in depths of less than 30 feet, have been least successful, especially those constructed from lightweight material, such as automobile tires. The forces created by storm-driven waves through the vast fetch of the oceans and Gulf have literally resulted in automobile tire reefs being picked up and washed back onto the shore or being so completely disassembled and scattered in unknown directions that no trace of their presence remained. Attempts with heavy material such as that used for the Hermosa Beach Pier quarry rock reef have been more successful. However, the longshore movement of sand tends to bury, or partially bury, these materials during certain parts of the year, thus discouraging the growth of marine organisms.

Even in the protected waters of Puget Sound, storm and current energies can be great, but not nearly so great as those of the open coast. The irregular

shoreline of Puget Sound also creates many areas where the currents are always minimal. Under these conditions, and with the bottom topography such that nearshore reefs can easily be built below 30 feet, even automobile tire reefs can be used for marine habitat enhancement, without fear of their movement.

Habitat enhancement structures for the Edmonds fishing pier are constructed from automobile tires tied together with polypropylene line to form four specially designed modules. These modules are grouped into units that vary in height, in number and size of openings, and in distance between modules (Walton, 1979). This diversity in habitats is designed to enhance the area around the pier for various life history stages of several species of fish. The entire complex of structures is arranged to avoid creating obstructions for the pier fishery and to enhance an area large enough to sustain catches under intense fishing pressure. The design being tested for the Edmonds fishing pier has 1,000 feet of fishing railing space to offer access to approximately 20 per cent of the 4 acres of bottomland enhanced with habitat structures. The fishable enhanced area was increased in the Elliott Bay fishing pier design, where 900 feet of railing space provides access to approximately 50 per cent of the 4 acres of enhanced bottomland.

Summary and Recommendations

Pier location

The location of a recreational fishing pier is an important element in determining its success. Consideration should be given to the proximity of the clientele, the biological potential of the area, and the prevailing oceanographic conditions. A pier must be easily accessible to the clientele to receive maximum use, and often the renovation of an existing commercial pier is an economically attractive possibility. However, if the location cannot produce the fisheries resources necessary to sustain productive fishing, or if the location is seldom fishable because of inadequate water depths, strong tidal currents, turbidity, or other factors, or if the area is simply unattractive to anglers, investment in the facility as a recreational fishing pier cannot be justified.

Facility design

The optimal design for a fishing pier varies with the environmental and economic constraints affecting the specific location. However, a composite design can be drawn that meets the basic needs of both pier fishermen and pier operators. Fishing piers do not

have to be elaborate structures, but they should extend out from the shoreline as far as practical to provide access to a variety of bottom types and water depths.

The deck of the pier should be located as close to the water as local wave and tidal conditions allow. The fishing width of the deck should begin at the point where the first productive fishing depth is encountered and should continue for the remainder of the pier. The area of maximum water depth and other unusually productive fishing locations, such as are found near eelgrass beds or patches of reef, should have expanded deck space or extensions to maximize the available fishing railing space.

Railings must be placed around the entire deck and access walkways to provide a safety barrier for anglers, but they should not restrict fishing activities. The railings should be clear of all attached structures, such as light poles, to allow unobstructed movement along the pier. Lights for night fishing, benches, shelters, fish-cleaning stations, and other amenities should be located to avoid encumbrance of fishing space and to permit easy movement across the pier.

Concrete pilings should be considered for reduced maintenance. Their use minimizes the number of pilings required to support a pier, thus decreasing the potential for angling gear becoming entangled. The resulting loss of vertical habitat for fish and other organisms under the pier can be partially offset by other habitat enhancement structures.

A fishing pier should include a snack bar or restaurant and a bait and tackle concession on, or immediately adjacent to, the pier. The ability to purchase bait and tackle at the site allows the angler to adjust rapidly to constantly changing fishing conditions and fish availability. Restrooms and ample parking are also extremely important, as is convenient public transportation.

Management of the pier

The optimal management strategy for a fishing pier must accommodate anglers' needs, fisheries resources, and objectives of the personnel or agency establishing the facility. State regulatory agencies should consider all factors affecting the optimum operation of fishing piers when they establish their fishery regulations.

The thoroughness of the management strategy appears to most significantly affect pier use in those areas where alternate piers are readily available. It is clear from this study that a pier fishery will not manage itself but instead must be carefully managed if it is to produce significant recreational benefits.

The small business operations managing many of the piers in Florida and Texas and the community responsibility associated with certain public piers in California and Florida result in facilities that are

properly located, well maintained, clean, and heavily used. Some of the piers in Florida and California that are not owned or operated by concessionaires, especially those in big cities, are poorly maintained, dirty, and in many cases underutilized. However, when demand for fishing access is extremely high and no alternate piers are readily available, even these piers are crowded with anglers willing to tolerate the unsatisfactory conditions.

Such undesirable situations were not observed on piers that charge an admission or that are free access but are managed by a concessionaire or community-based group. High admission fees were not encountered in this survey. The charging of a minimal, almost token, fee results in what appears to be an almost barrier-free facility, heavily used by a socioeconomic mixture of avid recreational fishermen. However, even a small admission fee may curtail or eliminate use of the pier by some avid anglers who cannot afford this extra expenditure. In such cases, an alternate plan for free admission for certain anglers is highly desirable.

Willingness to pay a small admission fee usually indicates that people visiting the pier are there to use the facility for its intended purpose and that they place a value on the pier at least equal to the price of admission, plus the cost of getting there. This appreciation seems to result in an interest in the upkeep of the facility and reduces vandalism and maintenance costs. This minimal economic screening of the clientele does not eliminate all vandalism, but it does create an atmosphere where peer pressure and operator control are able to handle most problems.

Successful pier operators maintain the support of local anglers by offering season passes, multiple trip booklets, or other discounts for steady customers and by providing conveniences such as rental locker space or fishing rod storage. Steady customers are usually the expert anglers on the pier and are often easily persuaded to teach tourists, youngsters, and less-experienced fishermen the most productive fishing methods. Such personal contact creates not only knowledgeable, enthusiastic, and successful anglers, but also patrons who will come back on a regular basis.

Well-managed and well-maintained fishing piers frequently become social gathering places for the surrounding community, and "I'll meet you down at the pier" is a commonly heard remark among anglers and sightseers alike. Often a restaurant on, or adjacent to, the pier becomes an impromptu "clubhouse" or gathering place for local anglers where fish are re-caught several times, adding significantly to their recreational value. Fishing information is readily exchanged in these surroundings, creating a friendly atmosphere for the education of anglers new to the area.

Pier operators can increase participation in the fishery and encourage new anglers by sponsoring clinics on fishing methods, by offering special days for senior citizens, youth groups, and clubs; and by holding fishing contests. Bulletin boards, photo displays, and news releases about exceptional catches also entice potential anglers. It cannot be overemphasized, however, that none of these marketing strategies can substitute for cleanliness and courtesy.

Management of the pier fishery

To provide maximum recreational benefit, a pier fishery must receive special management consideration from the governing natural resource agency. Because a fishing pier concentrates a great deal of fishing effort into a confined area, it usually cannot be managed as if it were a boat fishery harvesting stocks over a broad area.

Fishing piers are often similar to small lakes and streams that receive heavy angling pressure. These fisheries may be managed through gear restrictions or bag limits, which allow a sustained yield while still maintaining high levels of angler satisfaction. Although piers fronting marine waters seemingly draw from an endless resource, a considerable portion of the catch may be based on relatively small resident populations of fish, especially when habitat enhancement structures are used in conjunction with a pier. Even when large numbers of migratory fish are in the area, the same management tools can be applied to create a more orderly and more enjoyable fishery.

The management of a pier fishery should be through regulations that vary with the seasonal abundance of fish and the number of fishermen. Restrictions on the amount and kind of gear should be used both to optimize the available railing space and to control the rate of harvest. When angling pressures or catches are low, it is appropriate to increase the number of rods allowed to each angler. When large numbers of anglers are using the pier and demand for fishing space is high, restricting anglers to one rod each is appropriate.

Daily bag or catch limits should be established for each species of fish to ensure that the harvest rate on these species can be sustained at a level that provides a satisfactory recreational experience for the greatest number of anglers without depleting the resource. However, limits are often established on an aggregate or group basis for biologically similar species. This reduces the complexity of the regulations by reducing the number of species that must be identified.

Daily bag limits can also be used to influence the value that anglers place on abundant, but often discarded, species of fish. By establishing a bag limit, the management agency often implies the need for controlling the harvest rate and also the

desirability of the species to other anglers. Bag limits used in concert with a promotion of proper cleaning techniques and table use are often sufficient to increase dramatically the utilization of less popular fish species. As these species become more accepted by anglers, these bag limits will sustain their availability. Recreational anglers tend to view bag limits in somewhat the same manner that par is viewed in golf--as a sought-after level of proficiency.

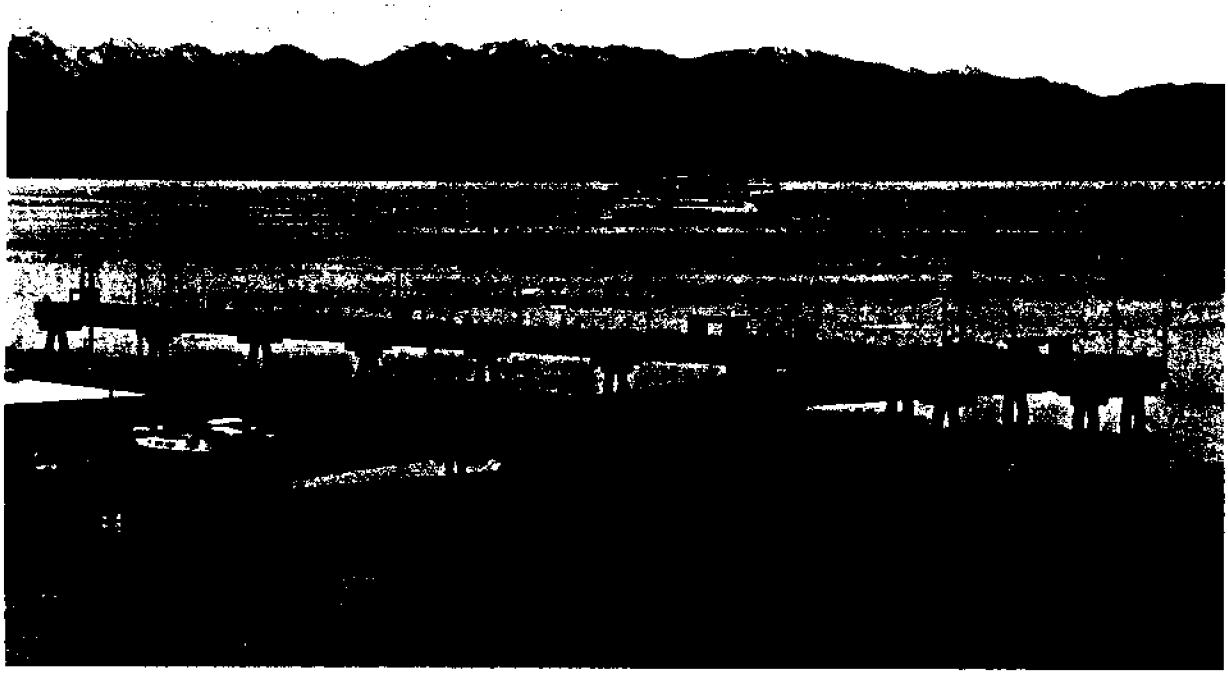
Minimum size limits are fishery management tools that can be effective in protecting the juveniles of some species of fish. The success of a minimum size limit in a pier fishery, where there is usually a considerable distance between the water and the deck of the pier, is significantly related to the hardiness of the species of fish and its ability to withstand the stresses of landing, unhooking, and release. These factors must be considered, along with size at recruitment to the spawning population and other characteristics that may justify imposition of a size limit. If the problem is critical and the species is susceptible to harvesting stresses, it may be possible to use restrictions on hook size, bait type, or other terminal gear to reduce the harvest of the size range needing protection.

Fishery enhancement

It is apparent from this survey that fishing pier habitat enhancement complexes and their associated management strategies are not appropriate for every pier fishery because of various environmental or fishery resource constraints. For example, the Hermosa Beach Pier quarry rock reef provides habitat for some species of fish, but unfortunately it also obstructs a popular open sand-bottom fishery for California halibut. There are many other instances in which attempts to enhance one fishery have been detrimental to another, and they clearly demonstrate the need to evaluate completely both environmental and fishery considerations prior to placement of habitat enhancement structures.

The Edmonds and Elliott Bay fishing pier habitat enhancement structures exemplify some of the considerations that should be given a pier enhancement complex. Most of the structures are beyond casting distance from the pier and are closed to all angling. The rationale for this placement is that an undisturbed population of fish can accrue, and only those fish moving toward the pier are likely to be harvested. To instigate this movement, enhancement modules are also placed under the pier. These structures are accessible to angling gear only with a directed effort. The area from the pier pilings out to the enhancement structures is essentially free of obstructions. This open space minimizes loss of gear and maintains a habitat for open sand-bottom species.

Both fishing piers also parallel shore-side quarry rock structures, which are man-made habitats supporting substantial kelp beds and fish populations. On the seaward side of the piers, parallel but in deeper water, are rows of other enhancement structures. The positions of these elements, plus the pilings supporting the piers, essentially direct the movement of fish migrating along the nearshore area down the lengths of the piers. This effect is similar to that created in a "Trolling Alley" fishing system (Myatt, 1978), making otherwise relatively inaccessible pelagic fishes available to the pier anglers.



Outlook for the Future

Shore-based recreational fishing is becoming increasingly popular in North America. Anglers in areas that have traditionally emphasized boat-based fisheries (such as the Pacific Northwest) are discovering that fishing from shore or from piers can be equally rewarding and far more economical. Continuing refinements in design and location requirements, and in management strategies for public fishing piers will provide more efficient access (including low energy consumption) to nearshore fishery resources for large numbers of anglers, often in major metropolitan areas.

In many instances, the addition of habitat enhancement structures in a pier area will increase the chances of providing productive, sustained fishing. Such structures function both to passively aggregate more transient fish species and to provide habitat and a food source for more resident fish species. Unfortunately, when improperly designed or located, these structures can also passively accumulate substantial amounts of terminal fishing gear. The Washington Department of Fisheries is conducting research into ways to minimize this tackle-fouling impact and still maximize resource enhancement by using different designs and materials for the habitat structures. Research projects are also being proposed for habitat enhancement in relatively shallow-water, high energy areas, such as on the open coast, or at sites with high currents. These efforts will explore the use of stable, medium-high habitat structures, such as an array of short concrete pilings or large quarry rock, to attract fish and to funnel migratory species toward and along a fishing pier.

Substantial progress has obviously been made in the design and operation of recreational fishing piers. Management of the fisheries associated with piers, however, has not kept pace with this progress. Natural resource agencies must examine existing and proposed fishing piers in their areas and bring together the needs of pier anglers, pier operators, and fishery resources into a coordinated management plan. The Washington Department of Fisheries is placing great emphasis on research and innovations in this area to increase benefits for fishermen using public piers.

Appendix: Fishing Pier Gear and Techniques

Fishermen in general, and pier fishermen in particular, are innovative in their approach to angling. Everything from small panfish rigs to large gamefish equipment can be seen on a given pier at the same time. Terminal tackle is almost as diverse, with single and multiple hooks, sliding sinkers and floats, jigs and set gear equally as common. Some of the more standard gear and also some innovative ideas are discussed in this appendix. Another excellent source for information about gear and techniques is Pier Fishing in North Carolina, by Robert J. Goldstein (1978).

Fishing gear carts

Well-equipped fishing pier anglers have a considerable amount of fishing-related gear that must be transported to their favorite location on the pier for each trip. As these anglers become more experienced, the amount of gear increases, requiring either several armloads, many friends, or a fishing gear cart. The designs of the carts observed in use varied from modified wagons and grocery carts, to specially crafted carriers with many conveniences. Their main features seemed to be large wheels for easy movement on rough surfaces, sufficient capacity to hold bulky items like buckets, coolers, folding chairs, etc., and the capability of being folded or easily disassembled for storage. Short sections of plastic pipe attached vertically to the sides of the carts made excellent rod-holders that kept the rods safe from breakage, but readily accessible for quick response to changing fishing conditions.

Rods and reels

The vast majority of fish caught off fishing piers weigh less than 10 pounds, do not require heavy gear for capture, and, in fact, are more likely to be caught if lighter tackle is used. To facilitate casting, light-to-moderate-weight terminal rigs and 7- to 9-foot rods are generally used. Shorter rods do not cast as far or control the terminal gear as well. Longer rods handle larger terminal gear, but they are more difficult to handle themselves. Jig fishing requires a stout rod, while other methods require a supple rod to feel the smallest bite. If an assortment of rods is not available, a good compromise is a rod with a strong backbone (usually the lower three-quarters of the rod), but a light tip. This will allow the rod to react to slight nibbles, but still have enough strength to set the hook on a large fish or one with a bony mouth.

The basic reel types are conventional (revolving spool) and spinning (fixed spool) based on reel-operating characteristics. Open-face spinning reels are the easiest to use, and unlike closed-face spinning reels, they can be thoroughly rinsed without disassembly. When underhand casting is required, spinning reels are by far the best and easiest to use. Conventional reels with a level wind are preferred by many of the more experienced fishermen, but these are more difficult to use.

An innovative (and less expensive) but less efficient approach that eliminates the conventional rod and reel is called a hand-line spinning reel. A 6-inch-diameter model observed in use was the PIONEER, manufactured by Boone Bait Company, Winter Park, Florida.[1] This device is used by winding the line on a special spool-shaped line holder. The terminal tackle is cast by hand, the line unwinding off the spool. The gear can be jigged in by hand or fished passively. Playing a fish and reeling it in require skill and sometimes a good pair of gloves.

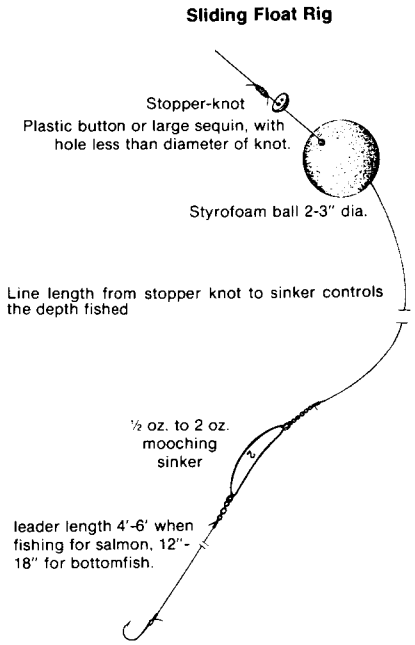
Handicapped anglers can also be quite innovative in compensating for their individual handicaps. Wheelchairs can be fitted with rod-holders, and the rods with electric reels. Small electric reels are not common in the United States, but one brand observed in use was the DUET-701 AUTO/MANUAL SPINNING REEL, developed and engineered in Tokyo by K. Ken Kogyo Co., Ltd., Tokyo, Japan.[1]

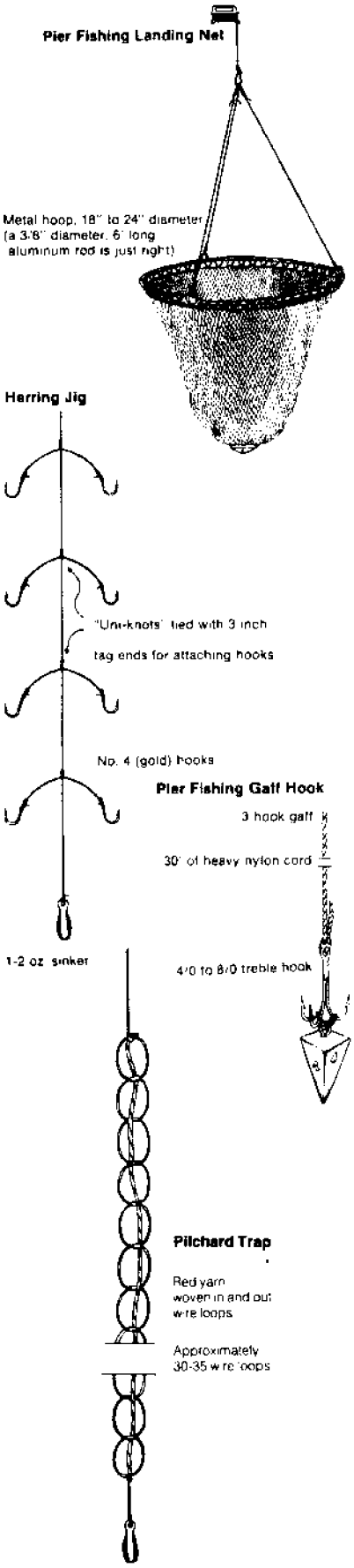
[1] Product noted in use during the survey but not endorsed by the authors or by Sea Grant.

Lines and terminal rigs

A 7-to-9-foot rod, coupled with 10- to 15-pound test line, is adequate to handle most fish caught from a pier. Even a large fish, up to 80 or 90 pounds, can be taken with this gear by a skilled angler. Many marine fish have very sharp, biting teeth that could easily cut such light line. Therefore, a heavy leader, 1 to 3 feet long, connecting the line to the terminal tackle, is used to resist bites, abrasions, and chaffing. In general, line strength should be matched with the fish being caught, i.e., lighter line for smaller fish. It is important to constantly check a line for nicks and abrasions that can quickly reduce it to a fraction of its original strength.

Terminal rigs are quite varied, but some of the more standard are simply sinkers, hooks, and jigs. The sliding float rig is designed to place the bait at an exact depth, and it is excellent for fishing over bottom obstructions such as reefs (Haw and Buckley, 1973). When the rig is cast, the weight pulls the line down through the float, while the float stays at the surface, stopping when the button encounters a stopper knot tied at a previously determined depth. The multiple hook and float rig is arranged after the lead weight is cast. Once the weight is on the bottom in the proper location, a sliding float is clipped to the line. This float is worked out as far as it will go; then a hook, line, and sinker hook-up is clipped





on and worked down to the float. A second float is then clipped on and worked down the line to about 10 feet from the first float. The second hook, line, and sinker hook-up is then dropped into place.

Landing devices

To land even a small fish from a pier 10 to 20 feet above the water requires either a stout line, a lot of luck, or both. To alleviate the problem, anglers have devised several landing methods. When the pier to water distance is not too great, a long-handled dip net or gaff is adequate. These are convenient if the handles "break down" into short sections for transport. For greater distances, a lift net can be worked under a tired fish, or a large weighted gang hook can be lowered and used as a "pier fishing" gaff.

Bait capture techniques

When sport fish are feeding on schools of forage fish around a pier, it is often desirable to capture some of these forage fish for bait. Although not legal in certain areas, a cast net is an effective bait-capturing device. It is a round net with lead weights around the perimeter. When properly thrown, the net opens into a perfect circle and all the leads strike the water simultaneously. As the net sinks, the baitfish are forced to the center and the leads are drawn together, capturing the fish (for example, see Dahlem, 1978).

Another technique is to tie several small, shiny single or treble hooks onto a line with a lead weight at the bottom. Hook sizes vary from No. 6 to No. 10, depending on the size of baitfish. This rig is then jigged through the bait. Although the fish will usually bite on the small baited hooks, a brightly colored piece of yarn tied to each hook or small brightly colored beads threaded onto the line will often improve results. One version of this method, used effectively in the South, is a pilchard trap. This consists of a series of small loops, ranging in diameter from dime to quarter size, made from fine wire or heavy monofilament. A bright red, yellow, or orange thread is laced through the loops and a small lead is attached to the bottom. When this rig is lowered into a school of baitfish, those fish moving in to investigate the brightly colored line are trapped in the loops.

Bait-holding containers

Once the bait has been captured or purchased, it is desirable to keep it alive and active as long as possible. If the pier is not equipped with live bait tanks, the bait can be held in perforated floating buckets that allow fresh saltwater circulation. Baitfish can also be held in floating wire mesh containers that are collapsible and easy to handle. Both can be attached to the pier railing with a short

piece of light rope. If the air temperature outside is similar to the water temperature, bait can be kept alive in nonmetallic containers when the water is aerated. Aeration can be accomplished with a small battery-operated aerator pump with O_2 tabs dissolved in the water or with the frequent addition of saltwater.

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