



AT LEFT, a nice catch of Tilapia from a ranch pond in Pima County.

Tilapia, A Fish For Ranch Ponds

W. J. McConnell

Recent advances in tropical agricultural fisheries may have some application in Arizona. The chronic protein shortage in many depressed tropical areas has spurred research in the development of better fishery methods and, last but not least, better strains of fish. At least one of these "new" fish might be the basis for a new kind of agricultural enterprise in southern Arizona.

The Malacca tilapia hybrid, developed at the Tropical Fish Culture Research Institute in Malacca, Malasia, has demonstrated several qualities which make them superior in several ways to our native pond fishes. The pure strain of the African species *Tilapia mossambica* has interested many fish culturists by its ability to grow fast in ponds on inexpensive rations, and because of its excellent table quality.

Population Can Be Limited

It has discouraged many other fish culturists, however, by another of its abilities; that of breeding so rapidly that its potential for rapid growth is suppressed by extremely dense populations. The Malacca hybrid tilapia, progeny of the mating of two closely

related races, cannot reproduce because only males result from the mating. Complete population control is thereby assured the fish culturist.

Both parent stocks were obtained by the Cooperative Wildlife Research Unit of the University of Arizona in July 1962. Production of hybrid fingerlings proved to be both easy and economical. Fry stocked in ponds near Tucson in 1963 and 1964 performed as they had in Malacca. No females have appeared among several hundred adult hybrids examined, and excellent growth rates at high population densities were realized. Unfed hybrids stocked as 0.75 inch fry on May 1 reached weights of six ounces by September 1 and nine ounces by November, at a stocking density of 600 fry per acre.

Survival rate in ponds stocked only with hybrids was about 75 percent. Even better performance was achieved by planting one inch fingerlings in mid-April and feeding with cotton-

seed meal pellets at the rate of 3 percent of body weight per day. Under these conditions, and at a stocking density of 2000 per acre, 4 ounce fish were produced by mid-July, 8 ounce fish by September; and many 10-12 ounce individuals by October.

The apparently high conversion ratio of cottonseed meal pellets to fish flesh is possible because tilapia are able to supplement their diet efficiently with large quantities of algae. No native pond fish can equal this combination of high total production and high individual growth rates on low cost diets, because none are able to use algae and cottonseed meal effectively as food.

Makes Lower Cost Protein

The cost of production of fingerlings is at least as low as any of our native varieties amenable to hatchery production, while the cost of production of harvestable hybrids should be much lower because of the ability of tilapia to grow on diets low in animal protein. Cottonseed pellets cost only 30 to 40 percent of the usual pelleted pond fish foods. It appears possible to raise 1000 pounds of hybrids per acre per season to harvestable size (4 to 12 oz.) for a cost of 20 to 30 cents per pound of live weight. Large scale production might further depress costs.

Probably the most lucrative enterprise based on tilapia hybrids would be the sale of recreational fishing. In desert regions where recreational fishing close to population centers is at a premium, sale of fishing privileges would result in the highest return per pound of fish.

The sale of tilapia to retail fish distributors might also have possibilities in regions remote from sources of fresh fish. The flesh of tilapia is similar in texture and taste to that of channel catfish, which has a steady demand in the retail fish trade.

Idea for Dude Ranches

For ranchers not interested in tilapia hybrids as a cash crop but desiring recreational fishing and tasty fresh fish for their own table, the tilapia hybrid, alone and in judicious combination with channel catfish, should be a superior pond fish. At the low population densities which are adequate to fill family needs, no feeding is necessary. In all trials conducted to date, tilapia hybrids have proven much superior to the bluegill as a fish for farm and ranch ponds.

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Value of Public Grazing Permits

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Throughout the history of the United States, public land policy has been one of the more persistent problems confronting the American people. For most of the 19th century, disposal of the public domain was the important public land policy question.

For the last half century or so, the public land issue has been management of the public domain. With a shifting and growing population and changing economic and social conditions, the questions of public land management remain far from being settled.

One of the chief issues in public land policy is what should the rancher pay the public for the privilege of using the range resource? In other words, what is the proper level for a grazing fee?

Basis for Discussion

As research economists, the authors

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There is considerable evidence that populations of most species of fish gain weight faster when composed of even-aged individuals, rather than several age classes. Thus high yields are common in new lakes and ponds where the fish populations also are "new."

With most of the native species of pond fish it is necessary to eradicate and restock to achieve this end. Tilapia, however, which will not winter in relatively cold water, die off completely each winter. This assures that the population planted each spring does not suffer competition from older established fish remaining from the previous season.

Provide Annual Replacements

An adequate and inexpensive supply of tilapia hybrid fingerlings would

of this report do not presume to suggest what the proper level should be for grazing fees, but we can lay out a framework within which the question may be rationally discussed.

In a free enterprise economy, the price of goods is settled in the market place. This price is influenced by the available supply of the goods in question and the purchaser's desire for quantities of that goods as expressed by his ability and willingness to pay. Thus, we say that the price level is settled by the law of supply and demand.

Although annual or monthly grazing fees are presently set by administrative order on a fairly arbitrary basis, this does not mean that the law of supply and demand is not at work. Under conditions of competition, the purchase price paid for units of the range resource is bid up until their cost is just equal to the net returns expected from the purchase of this resource. Ranchers would rather pay less than this, of course, but competition with other investors who are also seeking profits forces the purchase price to this level.

Has Purchasable Value

To whom do they pay this price? Part of it is paid to the government in the form of annual or monthly grazing fees. But public land grazing fees historically have been set below the competitive value of the public grazing permits. When a ranch is sold and the public grazing permits that it holds are transferred to its purchaser, the capitalized value of the difference between the grazing fee and the value of the product of the permit is reflected indirectly

depend on a commercial supplier who could take advantage of mass production savings. This operation might be similar to that of producing chicks for poultry production, and in itself has the possibility of developing into a restricted but profitable industry.

In addition to demand for tilapia hybrid fingerlings for commercial and private needs of ranchers and farmers, real estate developers in Arizona have a genuine need for professional fish management services to provide high quality fishing in ponds in housing developments, country clubs, etc.

It Has a Place

While fish culture has little prospect of becoming a major industry in Arizona it appears to have definite possibilities as a specialty enterprise based on a modest but steady demand for the product.

in the price of the ranch, or directly in the price of the permit itself.

The fact that Taylor grazing permits are accepted at banks as security for loans shows that these values are real and substantial. If the full competitive value of the grazing permit were charged by the government as the grazing fee, the permit would have no sale value upon transfer to a new permittee.

These conditions have generated a debate over the size of the permit value and to whom its purchase price should be paid. Some argue that the value is substantial, and since our government is society's trustee for the public grazing lands the people as a whole should receive its full competitive rental value.

No Intent to Profit?

Others argue that fee collection has always been primarily to cover administrative costs and has never been intended as a profit making enterprise. Further, even if the value of the grazing permit is substantially above the government fee, the present permittees have already paid the full value when they purchased the ranch. To raise fees now would unduly penalize the present permit holders. The low fee policy constituted a gift to the original permit recipients. But, this policy has not resulted in the subsidy of subsequent permittees because they have already paid the full competitive value to the former permit holder. If grazing fees were raised, ranchers would immediately see the results through the increased cost of production. At the same time, the reduced profits resulting from the cost increase would cause the sale value of the ranch to shrink, and result in a capital loss.

With this framework in mind, the authors set about answering the following two questions. First, what are ranchers actually paying for their permits to use the public lands? Secondly, by how much are current grazing fees below the full competitive value of the permits as measured by ranch purchasers themselves through what they are willing to pay for the permits.

From 1957 through 1963 a total of about 160 bona fide ranch sales occurred in Arizona BLM Grazing Districts 2 and 3, the BLM Section 15 areas, the intermingled state lands, and the Tonto National Forest. The purchasers in 66 of these transfers were interviewed relative to vari-

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