Trials of the Ocean Pickup: A High Performance Sail-Powered Trimaran in the Artisanal Fisheries of Guyana

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In 1978 I began research to develop a modern sail-powered vessel for the intercontinental transport of live agricultural and aquacultural materials (Todd, 1979). A 50-foot long, one-fifth scale model was developed to test modern rig concepts (Bolger, 1980). Concurrently, an overall evaluation of the viability of commercial sail in transport and fisheries was undertaken (Todd, 1980). The study indicated that the greatest need for modern sailing craft was in the artisanal fisheries of tropical countries with reliable wind regimes. Many nations are experiencing shortages of foreign exchange, and as a result, imported spare parts are often unavailable and fuel is expensive. As a consequence, artisanal fisheries are widely jeopardized. To find a viable long-term alternative, Ocean Arks International, a non-profit research and communication organization, started development of the Ocean Pickup for use as a commercial fishing vessel (Todd, 1983; Newick, 1983). The Ocean Pickup is a sail-powered multihull. Inherent in its design were three basic goals, namely that it be a high performance vessel capable of speeds equivalent to most motorized fishing vessels, that it be adapted to building in tropical countries, and finally that no more than 15% of the costs be in imported components. Fuel and foreign exchange savings for fishermen were central to the development of the concept.

THE TECHNOLOGIES

Construction.--Three comparatively new technologies have been refined and adapted in order to build vessels with excellent strength-to-weight ratios and cost effectiveness. This includes constant cambermold utilization which allows identically shaped, mass-producible wood strips to be fabricated into compound curve hulls (Brown, 1982). Secondly, epoxies and wood veneers have been combined to create composite building materials which are strong, light, rot-resistant and long-lived (Gougeon, Brothers, Inc., 1982). Finally, vacuum bagging, a method for holding the strips of wood on the mold and providing pressure for the bonding stage in the fabrication of the wood-epoxy composite boat material, has been developed to the stage where it can be employed inexpensively in small communities throughout the Third World (Marples, 1982). Figure 1 shows the 32-foot long right half of the main hull of the prototype just after it came off the constant camber mold.

Boat Wood Forestry.--The prototype was built from Douglas fir. However, we have experimented with an underutilized Guyanese species, *Baromalli*, and found it highly suited for the manufacture of wood/epoxy composite materials. In Costa Rica we have collaborated with NAISA to establish plantings of various trees to test as candidates for Ocean Pickups. These include Albizzia, Sesbania, Eucalyptus, and other fast growers. (McLarney, 1983). Melina, a tree from New Guinea, grew to boat-wood size in less than 3 years. Preliminary tests indicate Melina is epoxy compatible. We believe it is now possible for fast-growing, boat-wood plantations to be established on deforested tropical islands and coastal regions in order to build fishing fleets.

Naval Architecture.--Central to the success of the Ocean Pickup is the advanced naval architecture of Richard C. Newick, the designer of some of the world's fastest ocean racing multihulls including the last OSTAR (Observer Single Handed Transatlantic Race) winner "Moxie" (Weld, 1981).

The 1.5 ton prototype Ocean Pickup, a trimaran (Fig. 2) is 32-feet long (9.75 m) and has a beam of 20.75 feet (6.3 m), a draft of 1.25 feet (0.38 m) with the dagger board up, and 5 feet (1.5 m) with the board fully down. It weighs 2,000 lb (907 kg) and has a payload of 3,000 lb (1,360 kg). The Ocean Pickup is exceptionally strong and rugged for its weight. Its speed loaded is 5 kn in a calm with a 6 hp outboard auxillary, and under sail 6 kn in a 12-kn wind and 12 kn in a 20-kn wind. It can be operated from a beach; it is seaworthy and unsinkable. Its large deck area is suitable for many fishing methods and for many services. Hull panels can be laminated in a simple production facility and can be shipped nested for assembly where they will be used. One skilled builder can teach the construction methods, hence technology can be transferred rapidly. Figure 3 shows the vessel departing from New England, on 7 May 1983, for Bermuda and then on to Guyana.

FISHING TRIALS IN GUYANA

Drift Gill Net Fishery.--Drift gill netters account for about 40% of the Guyanese artisanal catch according to information supplied by the Ministry of Fisheries, Government of Guyana. The majority of vessels are large skiffs up to 35 feet in length (10.7 m) powered by 40 to 50 hp outboards. The skiff fishermen fish with mile-long gill nets, and their range is usually within 15 miles of the shore. Ice is not normally used, and fuel costs vary between $3,000 and $8,000 U.S. per year per vessel.[1] Auxiliary sails are often employed to reduce costs.

Larger diesel-powered drift gill netters range further afield and fish with 1,200 lb (544 kg), 1.5 mile-long (2.4 km) nets. Ice is used, and they often longline for snapper on the snapper

[1] Fuel cost estimates are based upon interviews with fishermen who fished with us. They all felt their range was somewhat fuel constrained. If they were to adopt Ocean Pickups, which would free them from fuel costs, without exception sthey stated they would range further to the richer grounds some 25 miles offshore. All calculations are based on an exchange rate of 3 Guyanese dollars to 1 U.S. dollar.

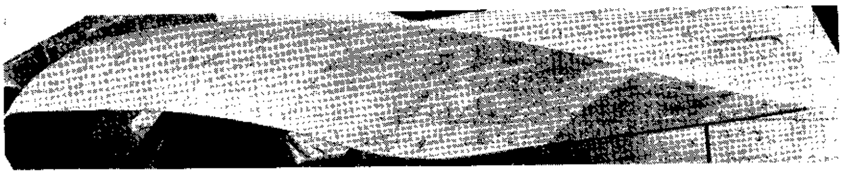

Figure 1. 32 foot right half of main hull of prototype of Ocean Pickup.

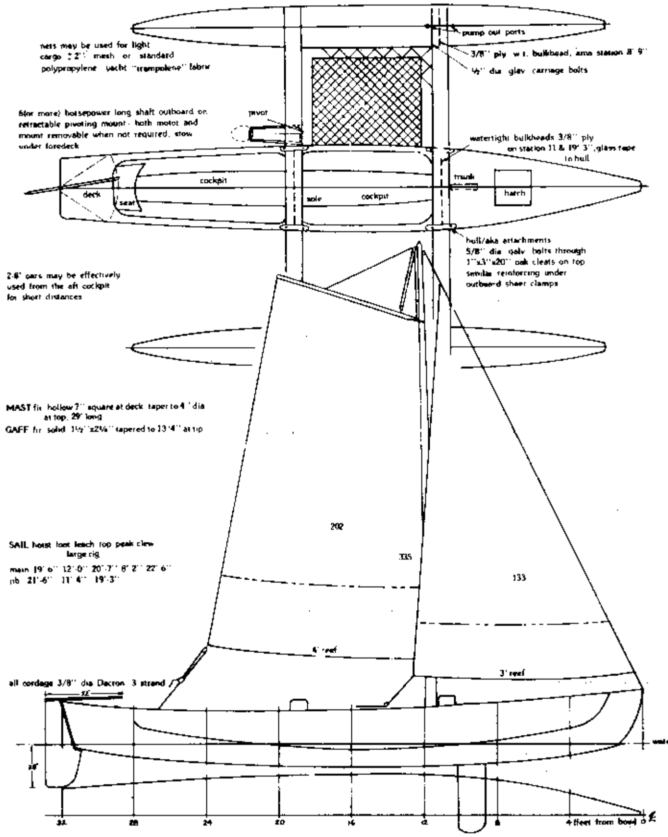

Figure 2. 1.5 ton prototype of Ocean Pickup.

grounds on the edge of the continental shelf.

The Ocean Pickup successfully set, fished, and hauled the 800 lb (362 kg), mile-long gill nets. Its stability allowed setting under conditions normally considered unsuitable for fishing. Our largest single catch was approximately 800 lb (362 kg) of marketable fish in a 2.5-h set. Catches were primarily four species of sea cat fishes (Ariidae) including gillbacker (Sciadeichthys flavescens), grey snapper (Cynoscion acoupa, sea trout (Cynoscion virescens), shad (Pellara sp.) and several unidentified species of small sharks.

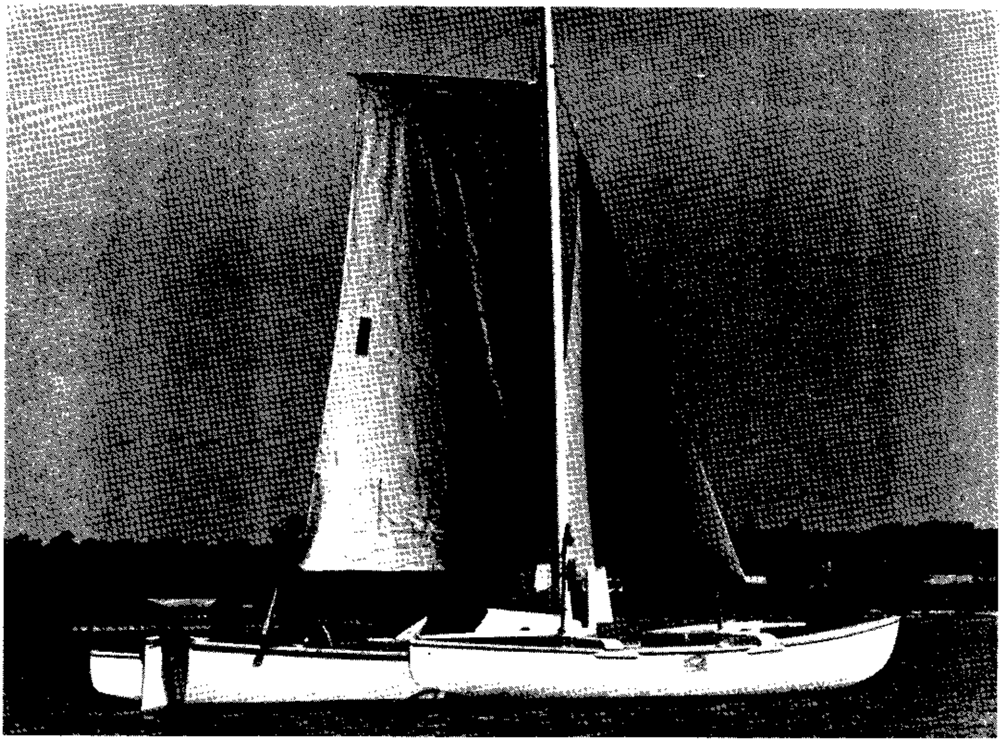

Figure 3. Ocean Pickup departing from New England on 7 May 1983 for Bermuda and Guyana.

Other Fishing Trials.--During the 2-month demonstration period, we had little opportunity to test the Ocean Pickup's trawling gear which had worked for us in New England the previous winter. The longline, including shark gear, shrimp trawl, and snapper/grouper gear, were not tested. Preliminary trolling experiments proved moderately successful. Mackerel or kingfish (Scomberomorus cavalla) were caught on each trial in small numbers. In one instance, a yellowfin tuna (Thunnus albacares) was caught. Since yellowfin tuna normally move north from Guyanese waters in May, this was unexpected (Kawaguchi, 1974). It is quite possible, that with further research, trolling with Ocean Pickups could prove valuable. They are able to sustain trolling speeds of 6 kn under sail which is the optimum velocity for capturing tuna and related species (Yesaki, 1977). It would seem that sail-powered trolling for pelagic resources may open up new fishery resources for trade wind regions.

By-Catch from Shrimp Trawlers.--Fish are often a by-catch of the shrimp trawlers. Trawler/shrimp economics rarely permit the processing and storage of fishes. By-catch recovery in the past has been hindered by a lack of cost effectiveness, but in 1982 Capt. Kurt Arnold of GOPA, a German fishery consulting firm, calculated that a suitably sized Ocean Pickup would be economical as a by-catch boat.

By-catch retrieval from a Guyana Fisheries Limited trawler was successfully accomplished with the prototype. We found that it was possible to tie the bow of the Ocean Pickup to a bridle attached to outspread trawling booms on the shrimper. This allowed the Ocean Pickup and the trawler to come alongside each other safely, and to compensate for their different rolling motions. As a result, we were able to directly transfer fish from the trawler to the outer hull of the trimaran, and quickly return the catch to Georgetown.

A major by-catch problem remaining to be solved is rendezvousing on the outer shrimping grounds where the precise location of the trawlers is unknown. One possible solution would be through the use of Single Side Band (SSB) radios and radio direction finders (RDF). The SSBs would be used for communication and the RDFs for homing in on a radio signal being transmitted by the trawler.

The prototype 1.5-ton Ocean Pickup used to test the feasibility of a sail-powered by-catch boat may be too small to be effective as a by-catch boat. It lacked an insulated ice hold or refrigeration. It did, however, demonstrate the feasibility of by-catch retrieval with high performance sailing trimarans.

ECONOMIC PROJECTIONS

<u>1.5-Ton Ocean Pickup in the Drift Gill Net Fishery</u>.--Table 1 provides a preliminary economic projection of a 1.5-ton Ocean Pickup built in Guyana and operating primarily in the drift gill net fishery. The value of the catch is based upon the average price we received for fish sold in the market. It does not include the value of prized pelagic species caught while trolling.

Table 1. Preliminary economic projection of 1.5-ton Ocean Pickup, owner skipper operated (based upon cost of $11,000 U.S. built in Guyana)

Operational Costs/Year	US$
Depreciation - 10 yr	1,100
Interest at 7%	770
Repairs at 5%	550
Fuel	200
Overhead at 10%	1,100
Insurance at 3%	330
One crew at $333/mo	4,000
Total Costs	8,050
Income	
Fishing: 250 days/yr	
Yield: ave. catch (200 lb/day)50,000 lb/yr	
Sales Mixed Catch: $0.40/lb	20,000
Net Annual Earnings	11,950

The catch, based upon 200 lb (90.7 kg) per day, may be conservative, as a number of the drift gill netters, with comparable hold capacity, catch up to 75,000 lb (34,013 kg) of fish per year. Also the economics of the drift gill net fishery can be looked at another way. Fuel savings alone with the Ocean Pickup fishing in waters out to 10 fathoms, or approximately 20 miles (30 km) offshore, would pay for the purchase of the vessel in as little as 18 months. The trimaran in the richer offshore fishery between 10 and 20 fathoms would save over $12,000 annually in fuel and pay for itself in less than a year. The economic picture for Ocean Pickups is made even more favorable by current outboard spare part shortages. Some fishermen have been forced to purchase as many as five engines to obtain parts to keep one running (Ministry of Fisheries, 1979). Should the foreign exchange crisis deepen, the introduction of high performance sail craft may be the only long-term solution for much of the artisanal fishery.

By-Catch Vessels and Economics.--We have commissioned the design of a 3-ton capacity Ocean Pickup for by-catch retrieval of fish from the shrimp trawlers. The vessel is 40 feet (12.2 m) in length, displaces 10,400 lb (4,717 kg), and has an estimated cargo capacity of 6,000 lb (2,722 kg). It has an insulated fish hold and offshore capabilities. The 3-ton Ocean Pickup would also be suitable for snapper/grouper longlining and drift gill netting with the larger 1,200 lb (544 kg) nets.

As a by-catch vessel, it would probably be cost effective; however, a precise economic projection is not possible at this time. Although the prices paid for fishes by Guyana Fisheries Limited are known, the price that would be paid to the trawler captains for their catch is as yet undetermined. If the difference between the two was between 13 and 17 cents a pound, 3- to 8-ton capacity Ocean Pickups would be cost effective. Table 2 is an economic projection for a 3-ton Ocean Pickup as a by-catch vessel. The profit per year is estimated at $43,594. Even if the value of fish was half that of our estimate, the vessel would still be economically viable as a by- catch boat.

Table 2. Preliminary economic projection of a 3-ton Ocean Pickup in by-catch/buy back fishery (Estimated boat price - $39,600 U.S.)

Operational Costs/Year:*	US$
Depreciation -- 10 yr	3,933
Interest at 7%	2,772
Insurance at 3%	1,188
Repair at 5%	1,980
Fuel: 100 gal (Imperial) at $2.00/gal	200
Ice: 200 kg/trip at $0.05/kg	1,000
Overhead: 7% of landed fish	7,333
Cost of fish from trawlers at $0.07/lb	21,000
Two crew members at $667m	16,000
Total Costs	55,406
Income:	
100 trips/yr, 2.5 days each trip; half capacity or 3,000 lb fish average --	
100 x 3,000 lb x $0.33	99,000
Earnings per Year	43,594

*This price includes a 10 hp diesel auxiliary engine, a hydraulic hauler, and communication and navigation gear.

Also, these figures do not take into account the sale of highly valuable pelagic fish like tuna and mackerel caught in transit with trolling gear.

The 3-ton Ocean Pickup could be widely employed as a multi-purpose fishing vessel. The by-catch boat would require expensive navigation and communication equipment as well as auxiliary power. However, the same vessel, without the expensive gear or diesel, could still be used effectively as a drift gill netter, longliner, and trolling vessel. A stripped down version with an insulated fish hold would cost, if built in Guyana, an estimated $30,000 U.S. Ocean Arks International plans to design a 50 foot (15.24 m) Ocean Pickup in order to compare the relationship between length/displacement/fish-hold capacity of different sized Ocean Pickups. The cost effectiveness of each will be evaluated.

FUTURE

Guyana is currently evaluating the option of building a fleet of Ocean Pickups to serve its artisanal and by-catch fisheries. Should the project go ahead, O.A.I. will provide designs and technical training and will assist with all aspects of technology transfer. A comparable project is in the planning stages of Costa Rica. The latter project involves not only establishing a boat-building infrastructure, but the reforestation of the coastal Talamanca region with the involvement of the regional farm cooperative. Our long-range goal is to assist with the building of fishing fleets and with reforestation throughout the Caribbean region.

ACKNOWLEDGMENTS

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