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Trends in Fishing Craft Development

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The modern factory vessel with sophisticated accessories and the traditional craft represent two faces of development of fishing craft. The developments that have taken place in the past century in the industrial and traditional sectors the world over are discussed. In the mechanised sector the development brought about in materials for construction, hull form, marine engines, propulsion system and optimisation of energy are the major ones. Sophisticated navigational aids and computer-aided designing have come to stay.

Key words: Motorisation, mechanisation, factory vessel, navigational aids

Fishery resources are continuously exploited using fishing vessels whose number, size and effectiveness are always increasing. In the past, the major fish producing countries have implemented many developmental programmes in fisheries sector including craft, gear and accessories.

Artisanal fisheries characterised by the traditional ingenuity are still the major source of sea fish in India and several other countries. The redeeming feature of scientific advancements is the happy co-existence of the traditional and the modern sectors. This is true in the fisheries sector also. The small-scale fisheries uses only one fifth as much capital and one fourth to one fifth as much fuel per tonne of fish landed and creates hundred times more employment per unit investment than the large scale fishery (Panayotou, 1982). Globally, the development of fishing craft has been very fast in the mechanised sector in the past century with very little changes in the artisanal sector. With the exception of motorisation of canoes, use of nylon nets, simple deck machinery onboard, and introduction of a few models of beach landing craft the fishing technology of small-scale sector in many parts of the world remained largely unchanged.

Development of Mechanised Fishing Craft

After India became a signatory to the UN Law of the Sea in 1976 in a bid to exploit the vast expanse of 2.02 million km^2 sea, foreign participation was favoured which endowed the Indian fleet with capital, technical expertise, sophisticated instrumentation, international experience etc. to some measure. With the inputs of vessels, gear and effort a balance is to be struck as regards the availability of stock to achieve techno-economic optimum in exploitation. In large-scale fisheries entrepreneurial independence in decision making is of paramount importance.

Changes in the design of fishing vessel

The primary consideration, after deciding on the method of fishing, is the size of the vessel which should depend on several factors including ports of landing, number of other vessels in operation in the same zone, availability of trained crew, market, plans for future replacement, end usage etc. Development of a vessel ensuring crew comfort, improved fish handling, mechanisation, automation, etc. would need continuing effort. Equally debatable as size is the speed and placement of the main engine room, fish hold bridge, trawl winch, etc. The reliability of engine and onboard machinery should receive primary consideration than the speed, which should be an economical working speed both during trawling and free running conditions.

The position of the main propulsion machinery is important as it affects the capacity of the fish hold. The length-beam ratio has a bearing on hull form designing. The trend in construction of large fishing vessels is to adopt low prismatic coefficient. Lower prismatic coefficient than that generally used is superior and 0.525 has been found to be the best in waves.

During the early 1950s the majority of fishing boats had small freeboard which resulted in low stability. So attempts were made to build boats which assure maximum stability and safety at sea. Regulations were modified to increase the size and number of life raft and other rescue operations.

Tank tests came into existence as an aid in the development of efficient designs. This can help to find out the most economic hull shape and propeller design. By analysing the model test data of different hull forms the naval architects develop efficient hull forms for fishing vessels. Model testing paved the way for development of cruiser-conical stern in 1933. Improved comfort of this stern gave extra space for accommodation and reduced the risk of the ship being pooped. Quite often indications from tank tests will point out modifications in hull lines, particularly towards the end of the vessel, but it may conflict with other requirements such as the deck space, fish hold size etc. A desirable feature to be considered in the design of trawler is the proper consideration of the weight distribution and centre of buoyancy for ensuring that when the boat is pitching in sea the rise and fall at the stern may be the minimum. Alteration of basic coefficients may not offer wide margin in design.

Tools have been developed to measure stability of larger ships. Since there were no suitable standards to establish an adequate margin of stability, a stability criteria was made which regulated the value of Global Positioning System (GPS) and free load for fishing boats. In an endeavour to provide more stability to Japanese inshore fishing vessels, the net drum for the squid jigging machines were fabricated in carbon fibre reinforced plastic (CFRP) (Anon, 1996). The masts and other ship structures were also built in CFRP high-tech materials.

Recently, Beecham (1996) reported the development of an interchangeable hull mould that will allow construction of both V-bottom and round-bilge boats in fibreglass reinforced plastic (FRP). The mould will be split at the chine and the new craft will be round-bottomed monohedron hull with a knuckle down the hull side and a moderate flared bow. The vessel is reported fit for rock lobster fishing, wet line fishing and for sports fishing in Australian waters.

A super trawler ROS 785, perhaps the largest and most powerful in the world, measuring 116.4 m long and 17.7 m beam is under construction in Rotterdam for supplementing the German fishing fleet. The vessel is provided with 12 RSW tanks and a slurry ice plant of 40 tonnes per day capacity besides 40 vertical plate freezers (Anon, 1996). The development of a 20 m OAL, 6.80 m beam GRP hulled trawler with a bulbous bow for single boat pelagic and bottom trawling has been recently reported from France (Anon, 1996). Norwegian shipyard, Eidvisik Skipsbyggeri As has built 60.9 m purse seiner-trawler powered by 3500 hp engine which is reported to develop a speed of 17 knots with forward and aft side thrusters. The largest combination fishing vessel, a 70.6 m OAL purser-trawler with a speed of 18.0 knots with half-full tanks and 15-16 knots with full tanks has recently joined the UK fishing fleet (Anon, 1997). It has a margin hull but sleek fore-end lines. It is capable of holding 1750 t fish in 12 RSW tanks.

Changes According to Fishing Methods

Trawlers

In early days beam trawl was widely used in power trawling. Later, winches and gallows were designed and fitted on the deck to extend the range of operation. The stern ramp and stern trawler were then introduced. The next development was the pair trawling. Different types of arrangement of trawl winch, fairlead, bollard, gallows and derrick were tried out on the deck to suit different gear and method of trawling such as stern trawling or beam trawling. On factory trawlers large super structures were built so that frozen fish can be unloaded in a continuous central hatch. In the later years there was a trend towards building large sized trawlers and distant water trawlers of length 30-35 m LOA.

Purse seiners

The development of equipment such as power block, purse winch and use of brailer, lightweight, compact high-pressure hydraulic masted boom mounted winches and introduction of synthetic gear increased the efficiency of purse seiners.

Gill netters

The designs of the hull of the gill netters were developed from tugboat designs. Mechanical haulers were provided on gill netters which reduced labour. When higher power was used to attain higher speed, a flatter and wider transom resulted which in turn necessitated a fuller bow.

Materials for Boat Construction

The basic construction materials available to the boat building industry have not changed over the years. Traung (1964) has suggested the optimum size of vessels that can be economically built with different material.

Steel is a versatile boat building material. The rules for its use in shipbuilding are being constantly updated. Life span of well over 20 years, easiness to deal with complicated structures and the need to handle heavier loads in suspension in high gantries, power blocks and similar devices in purse seining and trawling have brought about an increased tendency towards the use of marine grade steel in vessel construction. With the advent of subsidy programmes of the government of India for vessels of LOA 20 m and above steel has become the most preferred material.

Development of Marine Engines

When the fishing fleet of the Scandinavian countries were motorised it was largely based on the use of hot bulb engines. For small fishing boats the hot bulb engine is replaced by diesel engines. In the 1960s medium speed engines upto 25 hp were available. These engines were directly coupled to the propellers. Another class of engine developed in this period was the auxiliary engine of 10-20 hp.

Petrol engines were also used onboard fishing boats. Presently they use high-speed diesel engines of capacity upto 500 hp. Many developments have taken place in reverse gear, reduction gear, exhaust system, lubrication system, cooling system and fuel system. Over the past many decades, propeller shafts were made of stainless steel and bronze. Now, adays only marine grade stainless steel is used for manufacture of propeller shafts. At present turbo-charged engines are available in almost all the power ranges. Since seawater cooling causes corrosion of cylinder block and head indirect cooling system was developed.

Fuel saving

Energy efficiency can be brought about in fisheries in two ways - energy conservation and devising technology for utilising alternative energy sources. In the former, it is achieved through fisheries regulation and management responding to low energy fishing methods and development of efficient designs and operational methods. One of the worst energy losses in the system is too much fishing effort chasing too few fish. For a trawler operating at short range a propeller designed for the free running speed would be a waste. When the gear is not matched with the towing ability of the vessel energy is wasted. Therefore it would be better if the design starts from the gear rather than the craft.

The computer programme FISH was developed to calculate the fuel consumption of fishing vessels for various fishing methods and to analyse different options for improving fuel efficiency. The fuel consumption is calculated assuming that the engine burns 0.25 l/h of fuel for each hp it develops. This varies with engine rpm and propeller selected.

Reduction in power can be achieved by increasing the length of the water line and reducing the displacement. Most engines have a minimum specific fuel consumption in the range of 10-80% of maximum revolutions/min (Endal, 1980).

The low initial cost, light weight (1/3 of inboard motor) and ease of installation are the main advantages of an out board motor. However, its high fuel consumption is its main disadvantage (Gulbrandsen, 1986).

Staying in fishing ground helps to save fuel. A controllable pitch propeller offers operational economy by changing the pitch to suit various conditions of load.

Development of Navigational Aids and Computer Aided Designing (CAD)

Developments in the area of navigation have been instrumental in increased production of fish. Modern sophisticated fishing vessels have single side band radio telephone (VHF), mobile phone, emergency position indicating radio beacon (EPIRB), satellite communicator with global positioning system (GPS), echo sounder, auto pilot, radar, TV and video recorder, software, engine panel, winch control panel, rudder angle indicators, power steering levers, fish room cooling panel, freon gas alarm, chart table etc.

A computer assisted design system of technology (SAPR-Russian abbreviation) has been jointly developed by two Russian Institutes. Computer analysis of fishing gear can provide a rapid means of estimating the resistance of fishing gear and determining the effects of changes to the parameters of the gear on the resistance. With developments in CAD the prospective buyers can conceptually visualise the computer models in full three-dimension view and walk through the interior part of the vessel to be satisfied with the deck and under-deck arrangements. Improved manoeuvrability augmented propulsion thrust, more functional electronics etc. have also resulted with the computerised designs.

Offshore fishing vessels of over 20 m LOA equipped with powerful power plants, massive gear, large crew and spacious fish holds will not be economically feasible if engaged in short range limited endurance operation.

A definite preference for vessels equipped for partial or complete processing of the catch, though popular in foreign vessels, is yet to gain operational acceptance in India. An improved design which can result only through a continuing effort may establish such facilities as automation and mechanisation, improved fish handling facilities, onboard processing, etc. but the basic consideration should also be given to crew comfort to keep the morale high under adverse working conditions.

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