Chapter 3

Improvements In Fishing Technology

One major element of economic development, technological innovation, has certainly been characteristic of Estancia's fishing industry ever since it began. New and improved means of catching fish have rapidly succeeded one another, the fishing grounds have vastly expanded, and the town has grown from a local production center to a major marketing and supply depot for the Visayan fishing industry. This chapter traces the sequence and pattern of technological innovation. Its consequences on labor and capital relations are discussed in the subsequent chapters.

Fishing Outfits and Methods

Prewar fishing techniques

Sapyáw. During most of the nineteenth century the local thinly scattered coastal population only engaged in subsistence fishing with hand lines, small nets, and traps. However, in the early 1890s vast schools of fish were discovered just offshore and commercial fishing outfits known as *sapyáw* based in Capiz (now Roxas City) began to operate in Estancia's waters. Since the supply of fish seemed extremely abundant, the sapyáw owners and crewmen settled along the coast, shifted the community center from its original inland location, and generally laid the foundations of today's fishing industry.

The sapyáw represented a revolutionary technological advance over the pevious one- or two-man subsistence-fishing methods. Sapyáw were composed of two long *bangkà* (boats) without outriggers, 35 to 50 feet long and five to six feet wide at the gunwales. In the early years of the century, entire sapyáw cost between ₱1,000 and ₱1,500.[5] One boat, the *mayór,* carried the *mananagat,* or master fisherman, who led the outfit to the fishing grounds and directed their labors. On the way home the mayór carried the bulk of the catch. The second boat, the *lambatan* (from *lambàt,* "net") carried the abaca-fiber net. The men propelled the boats by oars, and in later years by paddling. The boats carried crews of 14 to 24, a full two-boat outfit, thus requiring 28 to 48 hands. During the dulúm, the three weeks of the lunar month when the nights are darkest, the boats went out a few miles from shore and all kept

watch for the luminescence on the water indicating a school of fish swimming near the surface. When fish were spotted the two boats were paddled side by side to a point down current and close behind the school. Next they played out between them the "round haul seine," a large scoop-shaped net, about 100 or more feet on each edge, with a "bunt" in the center. The back or down-current edge of the net was held on the surface by floats, while the front edge, weighted with sinkers, sank deep into the water. With ropes attached to the sides and front edge of the net, the two boats then proceeded against the current, circling around the school from opposite directions. Meeting again in front of the school, they pulled the ropes taut, bringing the edges of the net to the surface and trapping the fish inside. The net and fish were then hauled in, the catch dumped into the mayor, and the net replaced in the lambatan. With luck, and if the winds and currents were not too strong, thousands of mackerel or sardines could be caught in a single "set" of the net, and "settings" might be repeated four times in one night. While nights passed without catch, most outfits apparently returned home in the morning with at least the mayór half filled with fish.

These outfits, while still technologically primitive, caught great quantities of tuloy (*Sardinella longiceps*) and revolutionized the local economy. Subsistence and supplemental fishing continued, but commercial production required regular shipping arrangements with larger markets, vast quantities of salt for preserving the catch as *binoro,* and other supplies to maintain the crewmen and their families. For the first time, nonagricultural labor came into demand, both for the outfits and for processing the fish, and large groups of often unrelated men were regularly working together in a joint enterprise. These innovations had occurred earlier in urban areas of the Visayas, but in Estancia, where fishing had previously involved simple subsistence techniques, this amounted to a major economic revolution.

Punót. In about 1915 the sapyáw which had started the industry going were replaced by *punót* (Tagalog *baklád),* or deep-sea fish corrals. Those *sapyawistas* who switched to cotton nets which were stronger than the original abaca ones, continued in operation for a few more years, but new investments were channelled into the more profitable punót. Like the sapyáw, punót were not a local development, but were introduced by migrant Tagalogs familiar with their construction, operation, and potential in the Manila Bay area.

In themselves fish corrals were not new to Estancia. Known as *tangkop,* they were often constructed in shallow waters where schools of fish were known or suspected to pass. They consisted of a line of bamboo poles driven into the sea bottom, supporting a matting of woven bamboo and rattan, which guided fish toward a one way enclosure or series of enclosures from which they could easily be netted. Using local materials and few special skills,

tangkop were part of the ancient repertory of subsistence-fishing techniques. In the 1920s investment in a tangkop rarely required more than ₱50. The innovation of the Tagalog migrants was to construct vastly larger traps with specially selected materials, in water 9 to 12 fathoms deep. This required special skills in underwater construction as the supporting stakes of *anahaw (Palma brava)* had to be firmly planted, if the trap was to withstand strong currents or rough weather. The materials and labor for the construction of a punót often cost as much as ₱2,000 to ₱3,000. Such an investment was about double that for a sapyáw, but was well warranted despite the operational limitation to at most nine months of the year--November through June--during the northeast monsoon when the weather is calmest. Well-placed punót might regularly catch several thousand fish a day. Maintenance costs were small and there was no large crew with which to share the catch. The *maestro* in charge of the technical aspects of construction and the later operation of the punót often received ₱5 a day until the capital investment was returned, and from then on, one-quarter of the catch. The handful of laborers who helped him were usually paid ₱1 per day. That the punót had to be rebuilt every year, often with new materials did not deter investments, for operating expenses were low and the catch large. And while the first ones were built by the Tagalog migrants, the local sapyáw owners quickly followed suit.

Kubkuban. In the middle 1920s two other new outfits appeared in Estancia, the *kubkuban,* introduced by fishermen from Samar, and the lawagán, another import from the Tagalog region. Both outfits quickly established themselves as effective in local waters and were adopted by local fishing operators. Kubkuban consisted of a single large bangkà carrying 22 to 30 men. They were rowed, though sometimes propelled by provisional sails as well. The net was rectangular, sometimes more than 750 feet long and from 60 to 120 feet deep, and was operated as a purse seine. Like the sapyáw, kubkuban fished in the dark of night. Upon reaching a school of fish, *kubkuberos* dropped overboard one end of the net which was attached to a float with a light on top. As quickly as possible the boat circled around the school until it reached the buoy again, playing out the net as it went. Floats kept the top of the net on the surface, and sinkers at the bottom made it hang down like a curtain all around the fish. A rope, passing through rings at the bottom edge of the net was then hauled in, closing the bottom of the net like a purse. With the fish trapped inside, the net could be drawn in, and the fish brailed out of the last remaining area and dumped into the boat. Kubkuban used a relatively coarse net (a fine mesh would have weighed more than the men could manage), and were thus most effective in catching larger fish. One local dealer recalls a catch of 50,000 mackerels in a single night.

Lawagán. Introduced slightly after the kubkuban, the lawagán used the same type of net (though somewhat enlarged) and manuevered as the earlier sapyáw, but also introduced two major innovations. First, instead of the two large bangkà chasing the schools of fish, three or four small out-riggered canoes, each carrying two kerosene pressure lamps, were added to outfit. Known as *iwagan* (from *iwag,* "light") they were towed to the fishing grounds and at dusk the two men on board lit the lamps. The bright light just above the surface of the water attracted large numbers of fish.[6] When the quantity was sufficient, the two large bangkà waiting nearby rowed into position and lowered the sapyáw-style net, trapping the fish clustered around the light. The iwagan could hasten the process and minimize the escape of fish, by slowly paddling toward the center of the net, drawing the fish along with them. The procedure could be repeated with the other iwagan several times in a night.

This larger, more complex, fishing technique required a crew of 50 to 65 men in five or six separate craft, and prompted a second innovation, the use of motor power. Instead of rowing or paddling, lawagán (and sometimes two full outfits) were towed to the fishing grounds by a *motór,* a motorboat with a small inboard engine. This saved the fishermen's energy for pulling the nets, kept the outfit together, and assured its arrival in even more distant fishing grounds in time to light the lamps at dusk. The motór also towed the outfits home again in the morning. Sometimes another large bangkà, the *lab-asan* (from *lab-as,* fresh fish), was added to the outfit, specifically to carry the catch. This made the actual fishing bangkà more rapidly maneuverable and effective. Motór might be given fish to carry, but fumes and oil from the engine often contaminated and devalued the catch. A separate lab-asan was ideal.

The kubkuban, and especially the lawagán, completely replaced the last remaining sapyáw. The lawagán demonstrated the value of motorization and by the mid-1930s, motór were being used to tow kubkuban as well. Having proved effective, outfit operators began investing larger sums in bigger engines and boats, and larger nets. By the early 1930s motorized lawagán cost ₱8,000 to ₱10,000 (kubkuban somewhat less), about triple the investment in punót. The returns, however, warranted it. For some time the catches of the punót had been declining, and investment in the big fish corrals dropped off. The relative productivity of the various outfits was hard to disguise, and the outfit operators were economically rational in their investment policies. Given capital to invest, relative profitability determined where it went.

Fishing remained, however, very risky. Bad storms might wreck an outfit or wash men overboard. By local standards ₱8,000 to ₱10,000 was a large investment, and even if the outfit owner did not personally direct operations

at sea, he still needed considerable managerial experience to handle a crew of 60 plus perhaps another dozen engaged in fish processing and handling on the shore. The result was a developing niche for a smaller, less costly, outfit which took advantage of the recent innovations. In the mid-1930s, the *basnigan,* a new outfit, quickly came to fill that role in Estancia.

Basnigan. This consisted of a single large bangkà, some 60 feet long with heavy widespread outriggers on both sides. Its stability permitted the use of sails, though rowing was still possible if the breeze died or was contrary to the line of advance. Sailing to the fishing grounds, rarely more than 5 to 10 miles offshore, was almost as reliable as being towed by a motór, though it might mean starting a little earlier and arriving home somewhat later in the morning. Like the lawagán, basnigan were night fishing outfits, employing pressure lamps to attract fish. But instead of spreading the lights on several craft, four to six lamps were grouped at the prow. When a sizeable school had gathered, a bag net *(basnig)* shaped like an inverted mosquito net was dropped overboard near the stern. Weighted, it sank beneath the boat, and was carried somewhat behind it by the current, thus not disturbing the fish assembled at the prow. Ropes from the sides and corners of the net, however, were secured by men standing on the outriggers. Next, the lights were slowly moved to the center of the craft, drawing the fish along with them. Once the school was regrouped directly beneath the boat, the net was raised underneath it from the corners of the outriggers. Working the net around to one side of the boat, the trapped fish could be dumped on board or brailed out. The whole operation, from lowering the net to landing the fish might take only 20 minutes and thus could be repeated as often as 10 to 15 times in a single night.

The advantages of the basnigan were many. Like the lawagán they used lights, but with several bunched together at the prow they attracted more fish. Lawagán and kubkuban nets being extremely large had to be made of a relatively coarse mesh, so they would not be too heavy to handle. Because it was relatively small, the basnigan net could be much finer, and thus capable of catching smaller fish, especially valuable anchovies which the other outfits lost. Since only one boat was needed, general maintenance costs were lower, and a crew of 15 to 25 was sufficient depending upon the size of the craft. Propelled by sails, there was neither need for a mechanic nor to purchase engines and fuels. Basnigan thus combined great productivity with initial and subsequent operating costs of less than half of those for lawagán and kubkuban. The result was a rapid proliferation of basnigan after 1935, and at the outbreak of the World War II they dominated the fishing industry of Estancia. Their competitive advantage over the kubkuban was particularly marked, and the kubkuban owners rapidly sold off their outfits and reinvested in basnigan.

Postwar innovations

During the war commercial fishing came to a halt in Estancia as people scattered to the islands and inland, supporting themselves by subsistence agriculture and fishing. When peace returned, however, two new pieces of technology made available by the war were quickly adopted: generators and explosives. War-surplus electrical generators were almost immediately installed on basnigan, for they provided steadier and more intense light and because electric bulbs on well-insulated wiring could be lowered directly into the water (which kerosene pressure lamps, of course, could not). The increased catch warranted the extra investment, but generators could not be installed on the small, too often swamped iwagan of the lawagán, and they remain dependent upon pressure lamps. Against this competition, lawagán maintained their profitability only by (1) using new, stronger, larger, and lighter nets made of synthetic fibers; (2) fishing in further areas which the basnigan could not reach easily by sail; and (3) combining in the motór, the earlier roles of labasan (fish carrier) and the mayór, the lead fishing boat. With these modifications lawagán were able to compete with basnigan, even when they, too, became motorized in the early 1950s. Today, the initial investment (₱35,000 to ₱40,000) and monthly operating costs (about ₱2,000) of a new lawagán, are about double those of a new basnigan (₱15,000 to ₱18,000 and about ₱1,000 per month), but with the huge nets now used, often more than 150 to 200 yards in each direction, the catch is usually large enough to make the outfit quite competitive.

Palopók. Although explosives apparently had not reached Estancia before the war, there were published complaints (Roxas 1940) about their use in Manila Bay fishing grounds in the 1930s. After the war, however, many Estanciahanons became familiar with their potential and a brisk trade developed in explosives and fuses (initially from war-surplus dealers, but presently from other sources as well), which had lasted until today. There are two distinct commercially profitable techniques for using explosives, *kolorato* (from potassium chlorate), currently employed in Estancia. One technique, *palapók* (from *lopók*, "to explode") requires only two men in a small bangkà. Paddling out to rocky or corraline areas 5 to 10 fathoms deep, they search for large demersal (bottom-dwelling) species such as *mansâ*, Malabar cavalla (*Caranx malabricus*), *lapu lapu* grouper (various species of the genus *Epinephelus*) *ba-olo*, jack or cavalla (*Caranx melampygas*), and others. When fish are located, the fishermen toss overboard the explosive packed in a beer bottle or quart oil can with a fuse set to go off at the proper depth. The blast may kill fish 40 to 50 yards away. Thousands at a time can be taken in this manner. The fishermen cannot, however, immediately dive in to collect the fish from the bottom because sharks are often attracted by the explosion.

They therefore wait about half an hour for any nearby sharks to start feeding on the fish, for experience has indicated that sharks thus occupied tend not to attack human beings swimming in the vicinity. The fishermen then take turns diving with a hand net, *sibut,* bringing up fish from the seabed. This fishing technique of course destroys breeding grounds, billions of fish eggs, small fish, and vast amounts of microscopic plant and animal foods. Most of the once prolific offshore shallows which initially brought Estancia its fame are now underwater wastelands. Nonetheless, with luck, a *ganta* (two liters) of kolorato costing ₱30 may produce a catch worth ₱2,000. Though highly illegal, this potential earnings ratio is too high to be ignored by some of the local fishermen even if it means the ultimate destruction of the fishing grounds.

Largarete. Introduced locally in the early 1950s, *largarete* consist of a single bangkà 35 to 50 feet long with outriggers, powered by a small motor or engine. They carry a crew of five to seven, and often look like a scaled-down basnigan. The fishing technique, however, is entirely different, using gill nets strung like a curtain in the water the length of the boat and beyond, supported by bamboo poles projecting fore and aft. Another section of gill net may be suspended between the boat and a float held at some distance by the current. Lights on board and beneath the water attract sardines and mackerels which are "gilled," that is, trapped by the gills as they attempt to swim through the net. Small explosive charges are also sometimes used, for they apparently diminish the fishes' awareness of the net and thus they more readily entangle themselves in it swimming around and attempting to approached the lights.[7] In the fishing grounds largarete can operate continuously through the night. While one net is being cleaned of fish (by hand), another is set beneath the boat catching still more. Largarete cost only ₱3,000 to ₱5,000 depending on size and the quality of the engine and generator. Operating expenses are likewise relatively low compared to basnigan and lawagán. As such, while largarete cannot equal the huge hauls of the larger outfits, relative to the investment, they catch enough to be highly competitive. One distinct advantage is that while fish from the larger outfits are rolled and rubbed together and against the net, losing many scales, fish caught by their gills and removed from a net by hand, retain their scales. This is a major consideration in determining quality, and fish from largarete generally sell for 15 to 25 percent more in the marketplace.

Inboard engines. The destructive effects of palopók fishing began to be felt a few years after the war. By 1952-53 the situation was so acute that inboard engines became an economic necessity for basnigan as well, despite the much greater initial, operating, and maintenance costs (about double that of a sailing basnigan). The remaining fishing grounds were in deep waters far off-

shore. The fishermen could not depend on sailing craft to carry them there in the evening and back again in the morning. Army-surplus engines had been equally available as generators after the war, but it was not until the explosives took their toll on the local ecology that they became economically advantageous and were generally adopted.

The consequences of motor power, however, went far beyond allowing fishing boats to reach deeper and more distant fishing grounds. Before the advent of engines, long trips and crossings of the Visayan Sea were generally considered too hazardous for regular trading relationships to develop between distant communities. Motorized boats on the other hand could travel great distances relatively quickly, thus reducing the danger of being caught in bad weather while still out on the open sea. Previously isolated coastal communities were suddenly given easy access to one another and to Estancia, its market and pier. As a result, a fishing industry suddenly burgeoned in many communities which, like the earlier Estancia, had previously known fishing as a purely subsistence activity.

The coastal communities of southern and western Masbate, for example, were particularly quick to develop their rich fishing grounds, and some 40 percent of the fish shipped to Manila via Estancia currently comes from outfits based there. About one-third of the boats arriving in Estancia on market days are from these communities, and the people they carry come not only to sell fish in the market or ship fish to Manila, but also buy their week's home-consumption and fishing supplies. These Masbateños alone consume some 30 percent of the fuel products sold in the town, and account for 25 to 35 percent of the town's business volume. Similarly, other communities along the Panay coast and as far as northern Negros and the Bantayan Islands developed or expanded commercial fishing activities, using Estancia as a supply and marketing base. Thus, the introduction of motor power transformed Estancia from a town living on the catch of its own outfits, into a complex regional marketing center in which local fish production was simply a single element.

Transportation

Transport system have similarly evolved from the earliest days when large, slow-moving sailing craft known as *batil* irregularly visited Estancia to exchange bulk quantities of rice, salt, and lumber for fish to be traded in ports throughout the central Philippines. By the 1920s small cargo steamers from Iloilo City came to Estancia on a more or less weekly basis. They anchored offshore and the fish was brought out to them in small boats. The concrete pier completed in 1935 greatly facilitated loading fish and unloading supplies and large interisland steamers on their way to Manila from southern

ports began to call in Estancia. These shipments were disrupted during World War II, but were resumed on a regular basis shortly afterwards. Currently, three boats a week stop in Estancia primarily to load fish for the Manila market.

Overland transport of fish has also increased as the road system of Panay improved and vehicular equipment became increasingly available, but the volume is still a small fraction of that shipped by sea. Most of the fish that leave Estancia by truck go to other large marketing centers where they are consumed or redistributed to smaller inland communities.

Fish Preservation

Aside from innovations in production technology, there have been major shifts in the dominant modes of preparing fish for market. Before World War II, most fish--and especially the oil sardine, or tuloy--were preserved by packing them in salt as *binoro* or *buro*.[8] Depending upon demand and the type of fish, several other methods of preservation were also used. Fish were sometimes smoked to make *tinapá*, salted and sun-dried to make *ugá*, roasted for *inasál*, or "cooked" in vinegar to produce *pinaksiw*. However preserved, the fish were then packed in tins or woven baskets for shipment to distant markets. After World War II, with the decline of the tuloy in local waters, the production of binoro fell off rapidly, and salting and drying for ugá became the dominant mode of fish preservation in Estancia. The other secondary methods mentioned above have almost completely disappeared, along with the irregular containers for shipping the fish. In the late 1940s Chinese merchants in Manila introduced a standardized wooden box with an internal capacity of 1.4 cubic feet for shipping salted and dried fish. These boxes, *kahon*, have become the standard measuring unit in the industry, except for anchovies which are sometimes sold by weight and larger fish which are packed on ice in wooden cases with a volume of from 1 to 2 cubic meters.

In the late 1930s the commonwealth government subsidized an experimental cannery in Estancia. It was destroyed during World War II and there has been little interest in reestablishing it because it proved quite unprofitable. In part this was due to the seasonal and short-term variability in the volume of fish caught locally. For economic operation, a cannery requires a reasonably constant flow of fish which Estancia could not always supply. Further, the catch often contained a variety of species which created sorting problems and wastage because some of the fish were unsuitable for canning. Finally, local fishermen were willing to sell their fish to the cannery only when the government fixed price was higher than what they could obtain in the open market. Were a cannery to be established again today these problems would probably reappear. In addition, current high tariffs on imported tomato paste

for packing with the fish and on tin plate for the cans themselves, in contrast to relatively low duties on imported canned fish, further reduced the possibilities of a profitable cannery in Estancia.

An Overview of Technological Change

Technology and profitability. Despite the difficulties in establishing canning operations, the technology of the fishing industry in Estancia has undergone considerable evolution in the past 70 years. A long series of fish-production and preservation systems have replaced one another in rapid succession, contradicting the frequent assertion that it is difficult to introduce new technology in the rural areas. While the town's agriculturists have largely adhered to traditional technology, the opposite has been true of its fishermen. More profitable innovations were quickly adopted and less efficient techniques discontinued. In fact, several of the current outfit owners are planning or experimenting with new types of fishing gear which they hope to adapt to local conditions. Furthermore, there are numerous smaller outfits of various types operating from Estancia in addition to the major commercial fishing outfits we have described. Shifts in ecological or marketing conditions may well give one of these outfits a competitive advantage and bring on a rapid increase in their number. It is true that new technology has been borrowed and adapted from elsewhere rather than developed locally, but given the usual technological lead of most urban areas over rural communities, this should not be surprising. What is essential is the willingness of most Estanciahanons to try out new technology and judge it on the basis of rational market criteria.

Estancia and Binon-an. Estancia's pattern of rapidly evolving technology is not unique in the area. A similar pattern holds for the large fishing barrio of Binon-an, (population ca. 2,600 in 1967) in the municipality of Batad, 8 miles south of Estancia. Over the past 60 years the dominant fishing gear in Binon-an has gone from sapyáw to punót to kubkuban to basnigan, to largarete- -each technique replacing the former in a few years' time. Currently, there are 80 largarete operating from Binon-an, but no other kinds of commercial outfit, despite the variety to be found in Estancia within sight up the coast. If anything, competitive advantage seems to work still more rigorously in this smaller community than in Estancia itself.

Estancia and the major fishing centers. Given the ease with which new technology has been accepted in Estancia, it is fair to ask why local fishing technology is still less developed than in other parts of the Philippines. Large modern trawlers and purse seines operate from Iloilo City, Cadiz City, and the Manila area, and are frequently seen fishing in Estancia's waters. Many local fishermen have worked on these outfits at one time or another. Techno-

logically, they are not beyond local capabilities and it is well known that their catch far exceeds those of Estancia's largest outfits. How is it then that the techniques used by these outfits have not been adopted in Estancia? And why are they not likely to be adopted in the foreseeable future?

Capital is one problem. The initial investment in a modern trawler or purse seine is at least eight to ten times that for the largest lawagán. Such sums would undoubtedly stretch, although they might not break, the financing ability of any local outfit owner. Furthermore, their high-fixed operating and maintenance costs necessitate maximum employment of the equipment. These outfits must fish almost continuously, following schools wherever they go in Philippine waters. The high costs and required mobility make it uneconomical to base such outfits at a small community like Estancia. An urban center with a large market, on the other hand, can absorb the fish immediately. In Estancia it must first be salted and dried before shipment to a larger market. Aside from the added costs of handling and preservation, dried fish sell far less than fresh fish. In other words, costs increase and returns are lower. Furthermore, the fuel, ice, and other fishing supplies are less expensive in the urban areas, and technically skilled labor is also more readily available there. The more modern outfits thus depend upon large commercial centers and mass markets. Fish consumption in the Estancia region is too low and the price of supplies too high for it to become a base of operations for more costly and productive modern outfits. One Estancia family did invest in such boats but they were operated from Manila by a relative who lived there.

It should be noted, however, that the numerous improvements in Estancia's fishing technology that have occurred, have resulted from pragmatic calculations by interested individuals and not from scientific research or laboratory-tested procedures. Government research aimed at the problems of production has not noticeably affected Estancia's fishing industry. Nonetheless, research on the migration and spawning patterns of the pelagic fish that form the mainstay of the industry might help to enlarge catches and to establish a more reasonable closed season, if necessary.

Súmmary

During the 70-year history of commercial fishing in Estancia, seven distinctly different fishing techniques have been utilized. Synthetic nets, inboard engines, generators, and electric lights have replaced local fiber nets, oar and sail power, and gasoline lanterns. Estancia's outfit owners have demonstrated a continuing interest in technological innovation. Only practical economic constraints, and not a conservative attitude toward technology, have prevented the level of technology in Estancia from reaching that found in the major urban centers.