Material Evidence for Early Commercial Fishing Activities on the Far South Coast of New South Wales

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Fishing has been a commercial activity in Australia from the early colonial period, becoming and remaining one of our biggest commercial industries. Until now material remains from the early Australian fishing industry have not been reported on. The archaeological remains of fishing technology in Australia reflects features of economic development, technology development, adaptation, material reuse and recycling and human resourcefulness. This paper describes some aspects of the history of European fishing in Australia, Australian commercial fishing technology and the remaining material evidence from early commercial fishing activities (1880s to 1940s) recorded on the far south coast of New South Wales.

This paper aims to give practitioners in the discipline of archaeology some initial knowledge concerning the material remains recoverable at early commercial fishing sites. Bruce Ryan (1965) provides a superb overview of the connection between industry development (including fishing) and settlement patterns on the south coast of New South Wales. Michael Lorimer (1984) has also made a major contribution to this field through a master's thesis concerning aspects of historical fishing in New South Wales from 1850 to 1930. Research for this current paper was originally compiled for my 1999 honours thesis in archaeology, designed to establish the existence and evaluate the importance of archaeological remains associated with the New South Wales fishing industry from approximately 1860 to 1950. In this research, three models were developed to locate, identify and interpret the archaeology of early commercial fishing sites in New South Wales. The project demonstrated that archaeological evidence for the fishing industry does exist and can be unequivocally distinguished from other land-based marine activities such as whaling and sealing; and that the archaeological importance of fishing remains lay in the identification of versatility and resourcefulness within an Australian industry (Bowen 1999).

Discussion on early commercial fishing in New South Wales provides insight into the technology and materials associated with the industry. The argument will reveal aspects of adaptation, technology development, economic development, mixed economic activity, and portrays a rapidly expanding and dynamic industry, which has developed into what is today Australia's fifth most valuable rural industry after wool, beef, wheat and dairy (affa.gov.au. June 2003).

Research for this paper was limited to a small section of the far south coast of New South Wales, within the area from Moruya to Bermagui, known here as the focus area (Fig. 1). A brief local history of the focus area identifies the features that attracted fishing people into the once isolated region. The development of commercial fishing within the focus area is shown to have contributed to other regional industries such as ice works and fish canneries.

Three identified commercial fishing sites are found to contain similar properties. Therefore, rather than discuss the material evidence on a site by site basis, evidence is given thematically. Material evidence for the New South Wales fishing industry is abundant; some site elements can be identified singularly, whilst others need to be associated with additional site features. The material evidence can define commercial fishing activities, technique, types of fish targeted, site usage periods, and the resourcefulness of commercial fishing people to adapt themselves and their equipment to develop new methods of sustaining an economic livelihood.

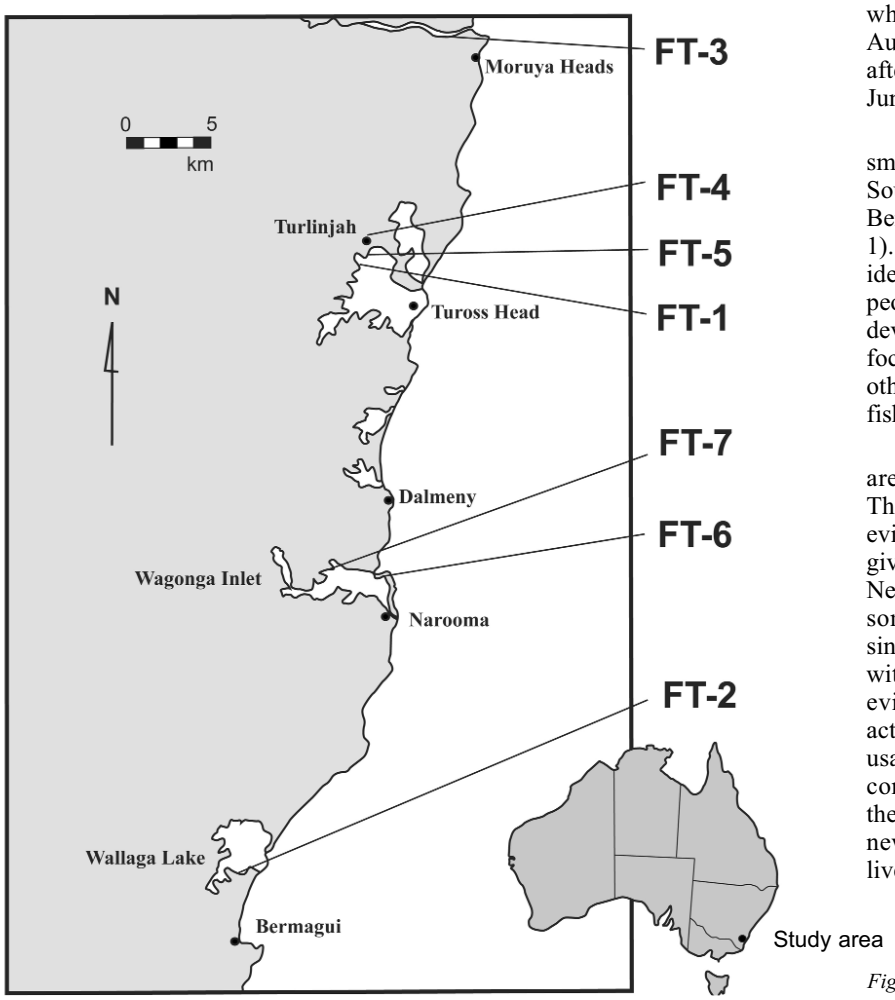

Fig. 1: Map of study area and sites.

HISTORY OF FOCUS AREA

The East Australian Current flows along the east and part of the south coast of Australia and continually carries large quantities of plankton, fish larvae, mollusc larvae, crustaceans and other nutrients directly into the south coast region (Hutchins & Swainston 1986:7). More nutrients enter the sea from rivers and become trapped, accumulating on the Australian continental shelf (Bennett 1974:230; Pownall 1979:12). These natural circumstances enable waters of the far south coast region to support a rich variety of marine species.

Due to early exploration in this region, many people were already aware of the area's plentiful supply of fish and other resources such as farmland, timber, seals and whales. By approximately the late 1840s to early 1850s, fishing people had moved into the area and were selling fish within their local communities (Nott 1992:87; Cameron 1987:78). At this time, the area was relatively isolated from more populated places such as Melbourne and Sydney. Tools or specialised working equipment were difficult to acquire and goods such as ice were totally unobtainable as only general supplies arrived monthly by sailing vessel from Sydney. Later in the 1850s, a steamboat began making weekly, sometimes fortnightly trips, depending on sea conditions, from Sydney to the far south coast settlements (Pacey 1990:23). The Sydney Ice Company opened in 1860, allowing ice (packed in sawdust) to be transported from Sydney to fishing people in the far south coast region (Lorimer 1984:100). Once ice became available, fishing people could sell their catch at the Sydney and Melbourne markets, encouraging them to intensify their efforts and establish a stable fishing industry within the focus area.

Before truck transport of fish began in the 1930s, sea transport was only possible where suitable access and docking facilities were available, such as at Moruya or Bermagui. Fish were also taken inland by horse and cart and later by truck, to sell at farmhouses or settlements. Large quantities of fish were transported inland to Goulburn in southeast NSW to reduce the incidence of goitre, a thyroid disorder caused through a deficiency in dietary iodine (Marieb 1998:604). Goulburn has iodine-poor soil and fish are an iodine-rich resource. Therefore, before the marketing of iodised foods, inland areas provided a market outlet for fish. Members of fishing families regularly sold fish door to door within their local community, often entering into a barter system in which fish were swapped for commodities such as vegetables, beef, mutton, chickens and eggs (Manning 1999 pers. com.).

With increased settlement, transport routes on the far south coast were established and commercial fishing activities became reliant on good road and transportation systems. Road transport enabled fish to be taken from a fishing site to market on a more regular basis than sea travel. In addition, road transport allowed supplies, such as ice, materials for net mending and net making, maintenance materials for launches, fuel for motor driven launches and lamps for night fishing to be delivered directly to site.

Within the focus area (and for Australia in general), minimal archaeological or historical research has been published relating to past aspects of the fishing industry. Due to the demanding nature of commercial fishing activities, people in this industry have led, and continue to lead, very busy lives. Perhaps for this reason they did not document events, activities, or details related to the industry they worked in, therefore resulting in a lack of documentary evidence for early commercial fishing activities.

Historical literature is limited to brief sections in local history books. For example, in Pacey (1990) *The story of Wagonga Inlet*, two pages are allocated to commercial fishing, however, there is no mention of the techniques, technology or materials used by the fishing people. Johnson's (1980) *Where highways meet: A history of Bateman's Bay and the Clyde and Tomakin rivers*, deals predominantly with prawning, scallops, oysters and abalone, also allowing two pages for commercial fishing. Archaeological research is even more limited with no references found concerning the land bases of historical commercial fishing activities. The lack of research into the New South Wales fishing industry adds strength to the importance of this study.

RESEARCH POTENTIAL OF FISHING SITES

A previous paper (Bowen 2003) has facilitated an understanding of the beginnings of the New South Wales fishing industry and how the theme of commercial fishing may benefit the discipline of historical archaeology in Australia. Once the presence and identification of fishing sites was established, a variety of research questions were formulated regarding fishing activities and their role in the development of historical Australia.

People from a number of different cultural backgrounds practised commercial fishing in colonial Australia. Australian Aboriginal people became involved in the fishing industry, as did immigrants from China, Italy, Greece and Britain. On arriving in Australia, immigrants practiced their own cultural methods of fishing, creating diversity in commercial fishing methods that should be visible in the archaeological record. In time, these varied fishing methods merged to become better suited to Australian conditions. This suggests archaeology of the early Australian fishing industry would be a rewarding subject for future ethnicity-related archaeological research.

The archaeology of early fishing can also contribute to research into social development and settlement patterns within historical Australia. Many of the far south coast settlements are positioned where early commercial fishing activities have taken place e.g., near lakes, estuaries and tidal inlets. It is possible (and archaeological evidence suggests) that some settlements were initially established by commercial fishing people. Further research into commercial fishing may provide access to new information on early settlements in Australia.

Comparative studies between aspects of the fishing industry and other early industries would also be rewarding. For example, exchange and interaction processes, ethnicity issues, technology transfer, economic and social development, and settlement patterns examined through the theme of commercial fishing could be compared with other Australian industries, like flour milling, lime production, gold mining, farming and timber cutting. Such research would enable a broader insight into colonial life in Australia and the human behaviours associated with it.

Before any of the areas outlined above can add to the discipline of archaeology, specific research must be conducted. In this paper, material evidence from early commercial fishing will act as another step towards developing the research areas discussed above.

HISTORY OF EUROPEAN FISHING IN AUSTRALIA

In 1789, John Palmer, a purser on board the *Sirius* (later he became the Commissary in charge of food distribution), documented that £1000 of fish were eaten every week in Sydney (Ollif & Crosthwaite 1977:59). With the initial shortage of food resources, the Sydney Commissary

encouraged people to eat fish by issuing six pounds of fish as a substitute for one pound of salt pork (Ollif & Crosthwaite 1977:60). Fish resources within the Sydney region provided an easily obtainable and cheap source of food for the British colonists, hence influencing the pursuit of fishing activities and later industry development (Clark 1977:27).

With Sydney's expanding population during the early 1800s, concern over food availability increased. Ice was unavailable, so fishing people could not venture far from Botany Bay or their catch would spoil before reaching market. By the mid 1800s, it was widely believed that the localised fishing was causing Sydney's fishing grounds to become over-fished and that new grounds were desperately needed (Mathieson 1987:308).

During the late 1800s, Greek and Italian immigrants became increasingly active in the New South Wales fishing industry, each using aspects of their own cultural methods to catch fish. In 1894, the NSW Parliament held a debate about the large number of Greek and Italian fishermen entering the industry and taking jobs that could have otherwise been filled by British fishermen. In addition, concern was voiced over whether Greek and Italian fishing methods (inshore fishing with gill nets) were to blame for Sydney's rapidly depleting fishing grounds (N.S.W.P.D., 1894:3443). Studies such as Lydon (1999:36) and Lorimer (1984), as well as oral histories (Rose 1999, pers. com.) tell us that Chinese people also fished commercially in early Australia. As yet, no historical or archaeological research has been done into the methods and technology Chinese people used to catch fish in Australia, and this remains an area of excellent potential for archaeological research. These documentary records reveal that during the New South Wales colonial period the dominant nationalities in the fishing industry were British, Greek, Italian, and Chinese.

Equipped with a range of fishing methods, colonists were fishing in the Australian environment with great success. Fish were seen as a virtually inexhaustible source of food. NSW State Parliamentary debate during the 1800s often discussed possible procedures to improve the fishing industry (such as deep-ocean trawling fleets) in order to add wholesome food and wealth to the colony (N.S.W.P.D. 1892:5590).

Regardless of the rapidly expanding nature of the commercial fishing industry, Australia's deep-ocean waters were ignored for fishing purposes during the 1800s, in favour of lakes, rivers, estuaries and other shallow waters abutting the coast (Cohen 1892:7). This assisted the development of efficient shallow water fishing methods.

Through ten years of determined government effort, general technological developments, and the Government importing the most modern trawling equipment from Britain, deep-ocean fishing did eventually become popular in Australia. By approximately 1925, a deep-ocean fishing industry, operated by private enterprise, was underway (Secomb 1995:41). People continued inshore shallow water fishing in the usual manner, however, deep-sea fishing introduced new methods and technologies that are identifiable in archaeological remains through site positions, the presence of larger, stronger quality equipment and new methods such as tuna poling and live bait tanks. These events have left a vivid archaeological record.

FISHING TECHNOLOGY

In New South Wales, commercial fishing was originally undertaken from a row or sail boat. The early 1900s saw some fishing people using the Frisco Standard motor, a single cylinder petrol/kerosene engine imported from Oakland California (Puglisi 1999 pers. com.). The most common methods of inshore fishing were hook and line, set nets (gill/drift net), beam nets (nets towed behind a launch with a timber beam positioned to keep the net mouth open), and seine nets (running a net around a school of fish) (Roughley 1953:201).

By approximately 1925, deep-sea fishing was underway and land-based locations for fishing sites began appearing not only on the margins of shallow water lakes, rivers and estuaries, but also at river entrances and ocean shores. Marine engines became more powerful and fishing vessels were larger. Lake fishing equipment changed with general technological advancements (synthetics, motors, winch equipment), but the basic fishing methods remained the same. Deep-sea fishing required much heavier, more robust equipment such as larger nets, strong winch equipment capable of hauling catches from deep-sea fishing grounds, heavy-duty slipways, large anchors, tuna poling equipment (poling for tuna was practised widely from the 1930s to the 1970s), and traps.

Fish traps were originally constructed from timber (later from metal), baited in the centre and set in the ocean for approximately 24 hours. Set nets remained the same for ocean fishing, only now built to a larger scale. Beams from beam nets limited the net size that could be easily handled. Therefore, for deep-ocean fishing the beam was replaced by two large planes called 'otter boards', set at an angle to each other so when the net was pulled through the water, the net mouth was forced open (Tilzey et al. 1990:1). People using seine nets in the ocean believed too many fish were escaping under the net and so in the 1930s the 'purse seine' was developed. To purse seine, once a school of fish is circled with the net, a string running through a series of rings attached to the bottom of the net is tightened. This closes the net bottom to prevent fish from escaping (Warn 1983:11). The new technology, equipment and location required for deep-sea fishing can identify a site's use to a later period in commercial fishing history. Improved road transport and refrigeration became available and this too had an impact on the facilities at commercial fishing sites.

Activities and equipment

Through field research, it became apparent that most equipment at early commercial fishing sites was set permanently in place and not intended to be relocated. For this reason, commercial land-based fishing sites often reveal intact *in situ* archaeological remains. A description of the activities and equipment necessary to successfully conduct commercial fishing during the late 1800s and early 1900s, will allow an understanding of the material remains that have been recovered and are recoverable from abandoned fishing sites.

Launch maintenance

Slipways are used to hold a launch out of water for maintenance purposes, necessary on average every six months. They were generally constructed from hardwood cut rough from the local area and held together with steel spikes. Any preparation work, such as foliage removal or morticing was completed by axe, as fine precision was not required. Some may have had steel track runners and wheels to allow the launch to move more freely. However, most had timber runners onto which the launch was dragged by hand. Bearer timbers were placed parallel to the shore, from below low tide mark to well above high tide mark. These were morticed to cradle timbers at a right angle to the bearers and nailed through the mortice section. Copper nails were used for launch construction and maintenance, as copper is resistant to

the corrosive marine environment. Pitch was used to mend leaky timber joints and oil-based paint acted as a protective coat on launch timbers (Brierley 1999 pers. com.). A capstan is used to secure a launch by rope or chain to a fixed position and any solid object may be used. In most cases a capstan will show wear marks formed by the swaying action of a rope or chain as it shifts with the movement of the launch.

Net making/mending rack

Cotton and hemp fishing nets were generally made by hand at fishing sites, and needed regular maintenance. This required a net rack, consisting of two tall, upright timber poles spaced to allow nets to be strung up and worked on. The top run of a net, containing the cork or glass floats, was pulled high between the poles, and the bottom net end containing the lead sinkers was tied low down on the poles (Shears 1999 pers. com.). New nets could then be constructed or holes in existing nets easily seen and mended.

Net tanning

Cotton and hemp net and line required tanning approximately every two weeks for preservation. To tan cotton material, natural tannin from tree bark was used. Bark was axed from the trunks of trees such as grey iron bark (*Eucalyptus paniculata*), grey she-oak (*Casuarina glauca*) and black wattle (*Acacia mearnsii*) (Boas 1947:136). Tree sap from red bloodwood (*Eucalyptus gummifera*) was used in some areas (Costermans 1981:71) Smaller trees such as black wattle were cut down before the bark was removed and therefore leave little evidence. Fishing people considered it extremely bad form to cut down an established gum tree or remove all its bark, for the sole purpose of exploiting tannin and this is why only strips of bark were taken from gum trees (Shears 1999, pers. com.). This left trees with visible scarring. Removed bark was chopped into small portions by axe and then boiled with the cotton or hemp material in a tank large enough to hold fishing nets. Tannin released from the bark penetrated the net material, leaving it brown in colour and temporarily resistant to sea water and jelly-fish acid. Tanned nets were then wrung out over the tank to ensure minimum wastage of tanning solution, which was reused. As tanning tanks were heated by fire, a hearth pit was dug and brick, stone or concrete pier stands were constructed for the tank to rest on. Often a worn out grader blade or flat steel bar was placed across the piers to help support the tank. Tanning tanks were usually positioned close to the shoreline as the tanks were filled by bucket from the lake or river (Jubb 1999 pers. com.).

Net drying racks

Cotton and hemp net material, replaced by synthetics in the late 1940s, needed drying after each use to prevent rotting. Net drying racks, constructed from local hardwood, were situated close to the shore so nets could be unloaded from the launch directly over the rack. Net drying racks consisted of a framework of upright and horizontal poles each approximately 100 mm in diameter. The height of drying racks varied as did the length, and average construction may be 1.5 m high and between 6 m to 12 m in length (Manning 1999 pers. com.).

When in use, fishing nets were hauled into a launch or shore using hand winches (Figs 2, 3), as light-weight mechanical winches were unavailable. This method allowed fish such as sea mullet (*Mugil cephalus*), bream (*Acanthopagrus butchen*), luderic (*Girella tricuspidata*), sand whiting (*Sillago ciliata*), sand flathead (*Platycephalus bassensis*), and eastern salmon (*Arripis trutta*) to be caught (Hutchins & Swainston 1986).

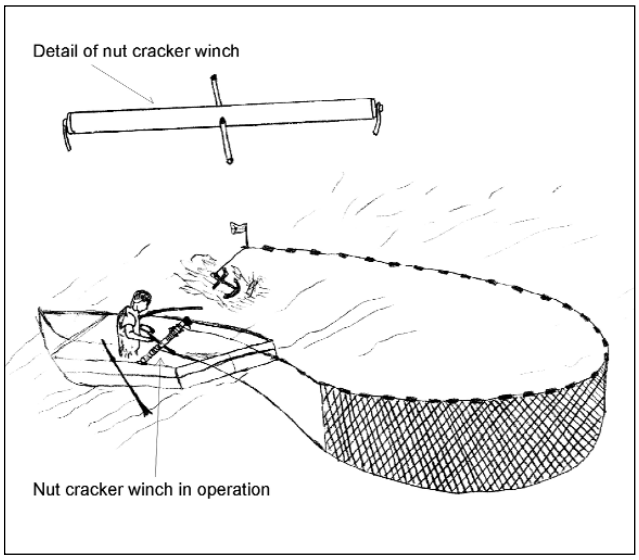

Fig. 2: A hand winch used for hauling in fishing nets from a launch, often called a nut cracker. On either end of the winch steel pins fit into the oar rowlock holes, rope tied to the net ends are placed on the timber shaft and the centre handle is turned to haul the net towards the boat (Bowen 1999).

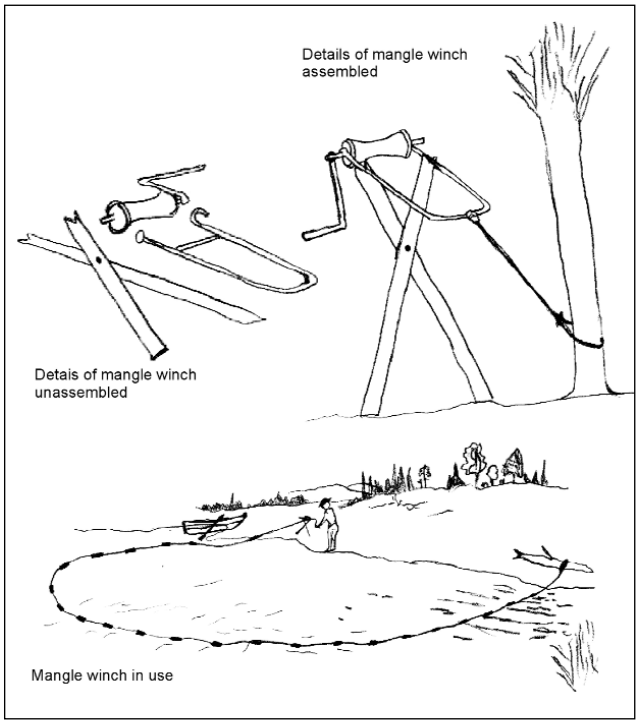

Fig. 3: A hand winch used for hauling in fishing nets from the shoreline, often called a mangle, is shown set up in operational position. A rope attached to the net is wrapped around the centre dolly and the handle is wound to winch the net into shore (Bowen 1999).

Fish storage box

Fish needed to be stored and preserved on site until transported to market. For this, boxes were constructed to hold fish and ice. Fish storage boxes were usually permanent fixtures constructed out of rammed concrete. They were characteristically built at the base of large shady trees to allow shade to keep stored fish from spoiling too rapidly through sun damage. Concrete iceboxes were constructed close to the shore allowing fish to be unloaded from a launch directly into the box.

The construction process for concrete boxes involved two timber planks approximately 150 mm wide, 19 mm thick and as long as the desired wall, fixed parallel to each other. The centre space between the planks was then filled with a reasonably dry concrete, sand and gravel mix and packed down by ramming the concrete with the flat end of a crowbar or purposely designed tool called a tamper. This method, using rammed earth rather than a dry concrete mix, was common in the pioneering days of Australia for single story buildings, low-level walls and for floor bearers (Edwards 1988:17, 37).

Fish cleaning platform

Certain varieties of fish, such as snapper (*Chrysophrys auratus*), required gutting to prevent decomposition. If a good catch was made, hundreds of fish may have required cleaning. A small platform was sometimes constructed a few metres into the water, where fish could be gutted and washed more easily than from the bank where the task would require bending over.

Platforms would be constructed so that at high tide they would not be under water and at low tide there would still be some water underneath so fish could be cleaned regardless of tide conditions (Shears 1999 pers. com.). Fish cleaning platforms have similar characteristics to a jetty, as they both require upright morticed posts and a platform above high tide mark, however size tells them apart. Jetties, defined as a private deck for mooring a launch and unloading cargoes (Kerr 1985), are bigger than fish cleaning platforms in every aspect, from their overall size to the wood used in construction.

Technology change

As technology advanced, changes within the material record at fishing sites are noticeable through major alterations to site positions and compositions. For example, early commercial fishing sites are always located on the banks of lakes, rivers and estuaries, only changing later in history to positions closer to the ocean. The advent of synthetic net and line material eliminated the need to tan and dry cotton nets, therefore trees were no longer exploited for tannin, and net and line tanning procedures became unnecessary.

Associated Structures

The early 1900s saw the development of ice factories in the far south coast region, which thrived until the advent of refrigeration (Birmingham et al. 1979:138). Fishing was an industry that required a lot of ice. If fish spoiled before reaching market, fishing people would still have to bear the cost of transport, ice, time, and materials used to catch the fish. The fishing industry was important to the economical survival of ice manufacturers therefore, ice-work factories can be linked to the expected regional landscape where commercial fishing activities occurred.

Another method of fish preservation, practiced by fishing people in the study area, was to keep surplus fish penned, preserving them live (Nugent 1980:31). In particular, salmon (*Arripis truttaceus*) enter rivers on the far south coast in great numbers to spawn during the winter months, enabling fishing people to net them in large quantities.

Fishing people at Narooma netted salmon entering the river annually from the 1930s to the late 1950s, after which the salmon began avoiding the inlet (Gaha & Hearn 1994:37). During this period, salmon were considered a poor eating fish, which gave them a low selling price, and large quantities were required to make catching them economically viable. The bulk of salmon was sold to the Narooma Fish Cannery, situated in Fosters Bay on the Wagonga Inlet. The cannery opened in 1937 and closed due to high overheads and lack of fish in 1960. It produced canned salmon for export and from the offal produced salmon oil, liver oil and fish meal (Pacey 1990:34). Usually, more fish were netted than the cannery could process making it necessary to preserve the fish alive until the cannery could take them. Netted fish were towed behind a launch to a pen into which they were released. When the fish were needed they were re-netted and towed to the cannery.

Fish canneries and salmon pens represent a definite sign of local commercial fishing activities. It would be uneconomical to build a cannery in an area where the majority of fish needed to be transported long distances for processing. Fish canneries or salmon pens are not commercial fishing sites, yet make up part of a landscape that indicates commercial fishing within the region. Fish canneries and salmon pens were located in many areas along the far south coast, which helped create and support other local industries, thereby assisting the development of regional centres.

SITES IDENTIFIED

Historical records reveal little information about abandoned fishing site locations. Field research was undertaken by contacting working and retired fishing people living within the study area. Detailed notes from documentary and oral histories were taken into the field and through extensive ground reconnaissance, three abandoned commercial fishing sites, FT–1, 2, 3, (Fishing Technology) and three associated structures, FT–4, 5, 6, were located (Fig. 1). FT–1 and 2 represent commercial lake fishing sites and are positioned on the bank of shallow water, tidal lake locations. FT–3 represents a commercial lake and ocean fishing site and is positioned on the bank of the Moruya River's main channel, close to the ocean entrance. FT–4 is an abandoned ice works factory, and FT–5 and 6 are salmon pens. Material evidence from the three identified commercial fishing sites will be discussed thematically, rather than on an individual site basis.

A commercial fishing site will generally extend along 30 m of bank and 10 m inland from high tide mark. Sites identified have all been subject to the damaging effects of human development in the far south coast region. Notably, council rates apply to any construction within ten metres of a river, lake or ocean bank, or a structure actually entering tidal waters such as a jetty or slipway. Accordingly, jetties and slipways on land previously occupied by fishing people have often been dismantled by current land owners to avoid incurring extra council rates. While this makes abandoned jetties and slipways scarce, some do remain in various states of disrepair. Elements such as fire, erosion, tidal conditions, weathering, and human scavenging have also had an impact on the archaeological remains at the identified sites. The sites are located in areas of sclerophyll south coast forest and bush land, and the common landscape feature is grass and scattered, stunted tree and bush growth.

Material Evidence

Slipways

Slipways constructed for lake (at FT–1 & 2) and ocean (at FT–3) vessel maintenance were represented at the sites. At low tide, dismantled slipways are often identifiable through their morticed main support beams remaining *in situ*, imbedded at the water's edge. Launch repair equipment such as copper nails, pitch, traces of oil-based paint, and broken sections of launches are noticeable in association with slipways.

Capstan

Three capstan types were represented at the fishing sites. Standing beside the remains of a concrete icebox, on the lake edge at FT–1, is a 1.5 m she-oak tree-stump displaying a distinct wear mark around the trunk. Lake fishing people would have moored their launch by rope to the tree, then unloaded the catch directly into the icebox.

The other two capstans (both at FT–3) could have been used to secure lake or ocean launches. One is a 700 mm round by 300 mm deep block of concrete with a centred chain securing point. This capstan is movable for mooring a launch in the water away from the bank or to the shoreline. The other capstan is a steel shaft (180 mm by 60 mm) and eyelet (170 mm in diameter) designed to be embedded into rock. The shaft is coated with an adhesive to help secure it into rock and the eyelet's inner circle shows extensive wear marks where a cable or chain has rubbed back and forth with the movement of a launch.

Net making/mending racks

Evidence for net making and mending racks was only identified at FT–1. One 3.5 m high, 100 mm round, upright hardwood pole was located. Wear marks 50 mm wide are visible 500 mm down from the top of the pole and 100 mm up from ground level, indicating where the top and bottom runs of a net had been tied. Approximately 9 m from the standing pole is a horizontal, presumably fallen pole of the same length and characteristics as the upright pole. Both poles would have once stood upright and had rope tied between them for the purpose of net mending and making. It was only that two poles were located showing the same wear marks that allowed reasonable identification. If suspected making/mending racks are only represented by ground-level post-hole indentations, shallow excavation squares placed between the represented poles may reveal lost net sinkers, broken glass/cork float or possibly net remains, thereby helping site equipment/ identification processes.

Net Tanning

Each of the identified fishing sites revealed the presence of scarred trees in and around the site location (Fig. 4). Another good indicator for net tanning is corrugated iron water tanks with the top cut off and signs of burning around the outside base and sides. Heating galvanised iron damages its zinc coating, exposing the bare iron to natural elements and causing it to rust quickly. Tanning tanks were found at each fishing site in various states of disrepair, measuring between 900 mm and 1.5 m round by 450 mm deep. The tanks were not *in situ*, and were possibly moved by wind action or dumped on the rubbish heap.

Hearth-pits, required under tanning tanks, are represented by ground depressions of varying width and depth, but at least 1 m wide with charcoal at the base. One pit at FT–1 revealed a number of charred, thin, flat, hand-sized rocks, scattered in and around the depression, and a worn out blade from a mechanical or horse drawn grader lying over one side of the hearth depression. When in use, this net-tanning hearth would have consisted of a tank positioned on two grader blades above a stone-lined pit. Two metres away from this pit a broken axe-head and shaft were located, probably used for obtaining and chopping tree bark for tanning. A heavily rusted steel milk container, located 1 m from the broken axe, may have been used to fill the tanning tank with water.

At FT–3, two different sized hearth pits were located beside each other. One is 2 m round, 0.5 m deep, with charcoal at its base. The other is 1 m round and 1 m deep, also with charcoal at its base. Small gauged fishing nets or prawn nets may have been tanned using a 200 litre (44 gallon) drum or washing copper over the small pit, while the larger pit was required for a larger tanning tank and nets. This variation in hearth pits could represent both ocean and lake fishing activities and is evidence of mixed economic activity through prawning and fishing.

Net-drying racks

The remains of net-drying racks were identified through standing posts (1.4 m high), post stubs at ground level and post-hole remains. The average post diameters are between 90 mm and 100 mm and were of hard wood cut rough from the tree. Embedded in the top of one standing post at FT–1 is a rusty nail, which would have once fixed a top horizontal rail onto the upright post. Two types of drying racks were identified, both in close location to net tanning areas. At FT–1 a rack is represented by two parallel rows of posts and post remains, set at right angles to the bank, with sufficient space for a small launch to fit between the rows. Two lines of drying racks probably extended into the water; however, no remains are visible below high-tide mark. The drying rack positions would allow nets to be unloaded from either side of a launch and hung directly over the racks, eliminating the need to carry heavy wet nets inland.

The other net-drying rack design, located at FT–3, was represented by hardwood posts and stumps, well above and running parallel to the high tide mark, forming a rectangle layout 4 m in width. Alongside this feature, lying on the

Fig. 4: Iron bark tree behind FT-1 showing a distinct scar down the trunk. Fishing people stripped bark in this manner to exploit the natural tannin in the bark for tanning fishing nets and line (Artefact FT-1-44, Bowen). 1999).

ground, was an 80 mm round hardwood timber, 6.2 m long with morticed sections 4 m apart. The morticed sections on the 80 mm timber match the distance between post stumps and would have acted as a horizontal timber to lay wet nets across. The major difference between the two net drying rack types is that one is set partly in the water allowing a launch to moor in the centre of the racks, with nets hung over a double row of horizontal timbers, while the second type is positioned above the water line and has a single horizontal timber for the nets to dry on. The first design would suit a relatively flat bank area and the second would suit a sharp incline or drop-off before the water's edge. Therefore, the difference in drying rack design may be due to different shoreline conditions.

Storage Ice Boxes

Fish storage iceboxes were built as permanent, sturdy constructions and have no other purpose than to store fish and ice. They represent an easily identifiable and existing feature of commercial fishing sites. A distinct feature of all located concrete iceboxes is the linear pattern of construction, which is characteristic of rammed earth and dry concrete walls (Fig. 5).

Fig. 5: This icebox is typical of the iceboxes found on the south coast. Slat marks formed through the dry packing process can clearly be seen as well as the box's position beside large shady trees (Bowen 1999).

Coarse sand, small stones or gravel from the immediate vicinity, mixed with a small amount of concrete, make up the materials used in the construction of iceboxes. This indicates construction occurred on site using mostly naturally available materials. Ice was unavailable within the focus area before 1860, indicating that commercial fishing sites located without an icebox may date to a very early era in commercial fishing history.

The concrete icebox at FT–1 differed from the standard as it showed signs of having had a concrete lid. This icebox is in a dilapidated state and the distinct linear pattern is only evident on some of the concrete sections. An old bed frame, grader blade, and car axle stub have been used as reinforcement within the concrete that has no lineal markings. The concrete box appears to have collapsed due to the metal reinforcement expanding with corrosion. Part of the concrete must have been poured as a slab, as reinforcement would not be required in the upright sides of a low-level wall, but would certainly be required in suspended horizontal concrete. It seems likely that a lid was fitted to this icebox, creating a cooler environment to make ice and stored fish last longer.

An alternative to the fixed position concrete icebox was located at FT–3. Measuring 2 m long, 1.2 m wide and 1.3 m deep, it is a similar size to the concrete iceboxes, but has a timber exterior, an 80 mm gap filled with shredded cork, and a sheet iron interior. This icebox is light and, when empty, could be easily carried by two people. The icebox could be kept undercover away from the elements, then when required, placed on the back of a vehicle for fish to be taken directly to market by the fishing people themselves, thereby reducing the cost of transport. Alternatively, the icebox may have been positioned on a launch, allowing fish to be placed immediately on ice. For fishing people to place an icebox on the back of a truck or on the deck of a launch would indicate a period when trucks and large open-decked vessels were in use. Therefore, a portable icebox also indicates a later period in fishing history (probably after 1925) than the concrete iceboxes.

Cleaning platform

Evidence for fish-cleaning platforms was located at only FT–1. Three metres into the water from high tide mark is a single vertical, 100 mm square, hardwood post rising 400 mm out of the water at high tide. One side of the post has a saw-cut mortice, 50 mm wide where a horizontal timber could be fitted, forming the bearers of a platform. The post is unlikely to be part of a jetty, as jetties required a lot of wood for construction and for economic reasons were generally rough cut from the bush, as opposed to this square-milled timber. Four similar posts were probably once present, holding a platform for cleaning fish.

The material evidence discussed so far, with the exception of capstans and the movable icebox, represent permanent structures not intended for relocation. As the constructed features of fishing sites have associations with each other, once one feature is identified it is possible to predict the occurrence of other features. For example, tanning tanks were positioned near net drying racks so that nets could be easily hung to dry after tanning. A launch needed to be moored while fish were unloaded, so a capstan would be located near a fish storage box. Access roads within a fishing site will lead directly to the fish storage box, as this (after the advent of road transport) is where fish were loaded for market.

Portable Artefacts

Less permanent artefacts are also capable of indicating early commercial fishing activities. Net floats, net pieces and net sinkers are often located at fishing sites. Cork net floats were always located in broken sections and not, as would be expected, in association with net material. Cork net floats were only used on lightweight, inshore, shallow water nets, as the heavier ocean nets would break the natural cork grain. Therefore, cork net floats indicate inshore fishing activities only. No glass net floats were located *in situ*, however, a number of glass net floats had been stored by a retired fisherman and were brought out for viewing. The floats were thick, round, hand blown glass in various shades of brown and green, their diameters were 60 mm, 80 mm, 125 mm, 150 mm and 175 mm. Net floats sized up to 125 mm were used for lightweight inshore situations, whereas larger floats were for ocean use to keep the bigger, heavier nets afloat and, because of their ocean application, indicate a later period in fishing history. Cheap, thin-walled (poor quality) glass floats were often imported from Portugal, however, good quality, thick glass net floats were available from Newcastle (Innes 1999 pers. com.). Excavations at fishing sites may reveal sections of glass net floats, as they tended to break easily.

Fishing nets, either cotton or hemp, and lead net sinkers (located at each site) are generally recovered in association with each other and in predictable places within a site. The likely locations for fishing net and sinkers to be recovered is on the water's edge, where launches were regularly moored such as near a concrete icebox, slipways and net-drying racks.

A possible reason for this is that torn sections of net left lying in a launch may eventually get thrown onto the bank whilst unloading fish at the icebox, or whilst a launch was receiving repairs on the slipway. Net square size ranged from 0.5 mm strands by 25 mm square mesh (at FT–1 & 2 indicating inshore fishing), to 4 mm strands with 200 mm square mesh (at FT–3 indicating deep-ocean fishing) and is usually located in a very fragile state. Cotton and hemp fishing net represents fishing activities occurring before the 1940 technological development of synthetics. Lead net sinkers are cylindrical of various lengths (between 15 mm and 150 mm long), and other than slight surface oxidisation, are in excellent condition.

Two hand winches for hauling in lake-fishing nets were located at FT–1 and a retired fisherman gave an account of their use. One is a 1.5 m length of 65 mm round, smooth, hardwood, with a 300 mm by 20 mm steel pin fixed through the centre. On either end of the timber length, small steel pins are fitted that lock into the oar rowlock holes. Ropes tied to the net ends are placed on the timber shaft and the centre handle is turned to haul the net towards the launch. This type of hand winch is called a nutcracker (Fig. 2). The other hand winch type was used for hauling fishing nets in from the shoreline and is called a mangle. The mangle consists of a timber cross frame (approximately 1.5 m high) with a dolly wheel and handle positioned on the top section of the cross. A rope attached to the net is wrapped around the centre dolly and the handle is wound to winch the net into the shore (Rose 1999 pers. com.) (Fig. 3). Both winch types represent inshore fishing methods and an early period e.g., before mechanical equipment in commercial fishing history.

A two speed gearbox, i.e. forward/reverse and sized only for a small (lake fishing) launch, was located at FT–1 and reveals the presence of motor-powered equipment. It is probable this gearbox is from a fishing launch, as only a launch would use a forward and reverse gearbox. This artefact may date to the early 1900s and shows the continued site use of FT–1 from hand-operated equipment, into the mechanical period of commercial fishing history.

A steel anchor of the Admiralty design measuring 1.5 m long, 700 mm across the arms and 75 mm thick was located at FT–3. The anchor stock and crown ring (for attaching the chain) are missing and were not located on site. Such a large anchor could only have been used on ocean-going vessels, most likely a trawling vessel. The anchor has now rusted beyond repair, but attests to fishing activities after 1925 and that launches of considerable size can be represented at fishing sites.

Dumped within the boundaries of FT–2 is a ruined flat top, four-ton truck. The dual rear wheel system and the heavy steel frame remain to suggest its carrying capacity. The front wheels, both doors and most of the cab are missing, but the mechanical parts remain, i.e. engine, differential, and gearbox. A steel frame from the back of the cab to one metre beyond the back wheels suggests the truck had an open tray back, with timber decking. Oral evidence suggests the truck was part of a fishing operation to take fish to market, pick up ice and other general jobs (Jubb 1999 pers. com.). The truck shows fishing people at this site had enough capital to outlay money on a truck and that these fishing people were actively participating in the enterprising nature of the times.

A large steel hand winch at FT–3 reveals how heavy launches were hauled from the water. Its main shaft allows a handle to be fitted on either side of the winch, for operation by two people if necessary. On the main shaft, a small diameter cog meshes with a large diameter cog attached to the winch barrel, which would hold wire or fibre rope. A brake system is fitted on the side of the coil drum and operates by forcing a fixed brake pad onto the spinning drum. The winch is designed to slowly move heavy objects. Its winding mechanism would be too slow for pulling in ocean fishing nets and too heavy for any lake fishing purposes. It was probably used in conjunction with a slipway for pulling large launches out of the water for maintenance purposes, adding to the evidence for FT–3's participation in deep-ocean fishing activities.

Seven heavily rusted solid steel rollers, dumped with a number of rusted lobster pots, were located at FT–3 on the lower side of an embankment and immersed at high tide. The internal width of the rollers is 75 mm, with flanges on both sides of the roller that would keep them on a track. Round centre pins, 25 mm in diameter and 125 mm long, protrude from the centre of the roller. The centre pins show wear marks where clamps may have been fastened, possibly to hold the rollers securely to a timber frame that would cradle a launch and roll up and down a slipway. The rollers internal width would fit onto standard steel rails, again suggesting they were part of a slipway. The number of wheels show that two frames with wheels were likely used on the slipway. More wheels are probably lost within the rubble on the bank. The heavy-duty hand winch and steel rollers would have been a large economic expense considering that launches were pulled out of the water only every six months. Therefore, it is likely that launch construction also occurred from this site, and/or the slipway was hired out to other launch owners for maintenance purposes. The lobster pots, heavy winch, and industrial slipway provide evidence for mixed economic activities and site use after 1925.

At FT–3 a modified motor vehicle differential was located, 1.8 m long and 450 mm wide. It has been modified into a winch for pulling in fishing nets, then mounted on a frame designed to bolt onto the deck of a launch (Fig. 6). The winch allows two ropes, i.e. both ends of a net, to be attached and hauled into a launch. Brake handles have been fitted enabling manual control of the spinning axles to ensure nets are brought in straight. This winch is a sign of deep-ocean fishing activities and another indication of fishing people's continuous efforts to adapt and re-modify equipment to suit fishing purposes.

Abandoned on a riverbank, north of the net-drying racks at FT–3, are two metal frames. Both frames are made from 25 mm galvanised iron tube with strong iron mesh forming a standing platform. The frames are designed to rest over the side of a launch on flat plate iron hooks. One frame is long enough to hold three standing people and the other could hold one person. In order to pole for tuna, a rack or cage was hung on the outside of a large ocean-going launch for fishing people to stand in while poling. These metal frame objects may be

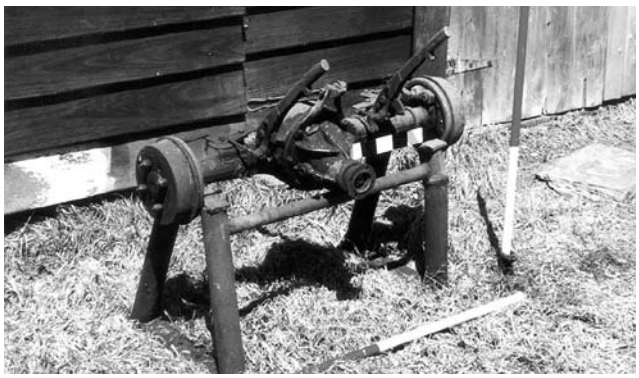

Fig. 6: Car differential converted into a winch to pull in fishing nets. Dollies are attached to the wheel ends of the differential and the shaft mounted. Hand-operated brakes are applied to ensure the net is pulled in evenly. The differential was converted and operated by the Manning family (Artefact FT-3-71, Bowen 1999).

tuna poling platforms, revealing ocean fishing activities and site use after 1930.

A steel tank, measuring 1.5 m square and made of 3 mm steel sheeting, with a 450 mm square opening on one surface was located at FT–3. When poling for tuna, live bait sends the tuna into a feeding frenzy and they are then caught with a hooked lure. This tank may have been constructed for holding live bait on a fishing trawler and the opening used to insert and extract the live bait.

A variation of the wicker pot traps used in Europe was found within the focus area. These traps are much bigger (usually three to four metres square, or semi-circular), made of wire and steel and would require mechanical lifting equipment, as opposed to the small, light European wicker pots. Both trap types operate on the same principle of fish entering the trap to retrieve bait, then once inside the trap design makes it difficult for fish to get out (QFITC 1988:15). The large size of these traps would suggest their use to be for ocean fishing.

Associated activities

The material remains discussed above are all good indicators of commercial fishing activities and, depending on the extent, type, and position of remains, may suggest a commercial fishing site. Another indicator of commercial fishing activities within a region can be seen through associated activities such as fish canneries and salmon pens.

McMillan's salmon pen was in use from the 1930s to the 1950s and is situated in Wagonga Inlet near the breakwater entrance. The pen is 240 m long and varies between 40 m and 80 m wide. It is on the inside break-wall of the main channel, allowing the back of the break-wall to act as a barrier to prevent fish escaping. The other side of McMillan's pen is a natural sand bar. The stone wall has been made out of sandstone quarried from the Narooma quarry only a few hundred metres north of McMillan's Pen.

To enable the fish to be placed in and taken out of the pen, a 4 m gap has been left in the stone break wall where a large iron gate was installed and operated manually by a handle and pulley system. The gate, wire cables, winding handle and pulley have since been removed and McMillan's pen remains open. A 3 m high by 300 mm square upright hardwood timber post that once held the gate and gate runners secure remains *in situ*. A concrete platform 3 m long and 1.5 m wide holds this post in place and once formed a smooth base for the gate to close. A hollow 300 mm square remains in the concrete to attest where another pole once helped to hold the gate runners and gate.

Again in Wagonga Inlet, a second and different type of pen was located. This pen utilises a natural inlet by stretching wire mesh across the inlet to form a semi-natural enclosure to pen fish. Two of these types of enclosures were used in the Wagonga Inlet, one stretched across the mouth of Freshwater Bay, and the other was on the opposite riverbank in Flying Fox Bay. Flying Fox Bay is now used as an oyster lease and access is possible only by flat bottom riverboat or many kilometres of bush walking.

Freshwater Bay is 200 m long and 50 m wide, and approximately 4.4 km from where Wagonga Inlet meets the sea. The surrounding riverbank consists of dense hardwood forest and to the back of the inlet an oyster lease now exists. To hold salmon, two wire ropes were stretched across the 50 m wide inlet, one weighted to the riverbed, the other above high tide level. To these ropes 50 mm wire mesh was fixed, with a join half way between each bank that acted as a gate.

At Freshwater Bay a gum tree 2.12 m round reveals scar marks where the main draw wire to hold the mesh was tied. The tree is still standing but is dead, probably a result of ring barking from the wire rope. A roll of discarded wire mesh is located on the east bank of the inlet. It was noted that the wire mesh had not rusted and under closer examination was revealed to be aluminium. Aluminium mesh costs considerably more and will last many years longer than its galvanised iron counterpart, suggesting that these pens were constructed with the intention of long-term use. These remains appear to be the only surviving evidence of the Freshwater Bay salmon pen.

For time and money to be spent constructing fish pens, the economic gain must have been substantial and fishing people must have believed that this method of preserving fish was going to continue for some time. The salmon still pass Narooma on their annual migrations, although now the fish travel far out to sea and this is where fishing people now seek them. Only the pens remain to attest the methods for holding masses of salmon that were previously caught and processed in Wagonga Inlet.

SUMMARY OF FINDINGS

As technology advanced, modifications occurred in fishing practices and some new methods were introduced. A major turning point for fishing people within the focus area was when steam engine vessels began bringing ice from Sydney in the 1860s and taking fish to be sold in Melbourne and Sydney. This further encouraged the development of commercial fishing activities. For another three-quarters of a century, lake, beach, and inshore ocean waters remained the target areas for commercial fishing activities. The material remains for this period reveal that commercial fishing people used predominately hand-operated equipment and worked in a physical, rather than mechanical, oriented industry.

With the NSW state governments ongoing push to establish a deep-sea fisheries and the increasing availability of suitable marine engines, by around 1925 deep-ocean waters were becoming targeted for commercial fishing. The introduction of ocean fishing is identifiable at FT–3 through site position and in the material record by an overall increase in equipment size, heavy mechanical apparatus, and different fishing methods such as poling for tuna, large steel fish traps, and heavy-duty large meshed fishing nets.

Like many early Australian commercial enterprises (see for example Pearson's (1996, 1998) work on flour milling technology or Gojak and Allen's (2000) exploration of gold processing technology) the material remains at commercial fishing sites show fishing people as extremely resourceful, often designing and making their own equipment, and were conscious of processes involving reuse and adaptation of materials. A vehicle differential converted to become net hauling equipment is an excellent example of resourcefulness. The old bed frame and automobile axle that were reused as concrete reinforcement, and worn out grader blades supporting tanning tanks above a fire attest that materials were recycled. Slipways and net racks were economically constructed of timber cut rough from the local environment. Possibly reflecting a shortage of proper equipment and materials (due to isolation), or perhaps not financially able to always buy purpose-built equipment, the adapted and reused items reveal commercial fishing people as innovative and resourceful.

Mixed economic activities in the form of launch construction, slipway hire, lobster trapping, prawning, ocean and lake fishing, and transport of fish to market appear to have taken place from commercial fishing sites. This indicates fishing people supplemented their income to make up for lost

time due to bad weather, a poor fishing season, or possibly for the sole purpose of creating extra wealth.

Ice works, fish canneries and salmon pens are part of the regional landscape that reveal aspects of early commercial fishing activities. The economic survival of ice factories and fish canneries was dependent on commercial fishing and would have helped the development of local and regional centres. Fish canneries and salmon pens are associated with each other and are a sign of commercial fishing activities. The expense and effort undergone to exploit salmon suggests fishing people believed long-term profit could be made (Rose 1999 pers. com.).

Reliable indicators of early commercial fishing sites are localised tree scarring, slipway remains, net drying rack remains, evidence of a net tanning area, and concrete iceboxes. In the regional landscape, tree scarring, fish canning factory remains and abandoned salmon pens offer evidence that early commercial fishing activities would have operated within the local area.

CONCLUSIONS

More information has now been added to the body of knowledge for Australian historical archaeology. A brief local history for the focus area identified the features that attracted fishing people into the region. Development of commercial fishing within the focus area was examined and shown to have diversified to include lake and ocean fishing, and helped to support other regional industries such as ice works and fish canneries.

As the located commercial fishing sites all shared similar properties, the material evidence was discussed thematically rather than on a site by site basis. Material evidence for early commercial fishing activities is abundant. Some artefacts require an association with site features, while others are singularly capable of identifying commercial fishing.

The material remains facilitate an understanding of the technology associated with the early New South Wales fishing industry, types of fish targeted, site use periods, adoption and adaptation of developing fishing methods, and economics within a rapidly expanding commercial fishing industry. The evidence indicates that commercial fishing people had a resourceful, determined nature, adapting themselves and their equipment to develop better and sometimes totally new fishing methods in order to sustain a livelihood.

The archaeology of early commercial fishing on the far south coast of New South Wales is a new and interesting topic. This work demonstrates the existence of the industry and its working mechanisms. In order to further develop the topic of commercial fishing in the context of historical archaeology and locate fishing sites that date to an earlier period, more research must be carried out in coastal and inland areas of Australia. Research of this nature is currently underway in Victoria, which has so far shown that many variables exist between states. Information from the two states will be used in a later comparative study. The situation for the rest of Australia remains to be seen.

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