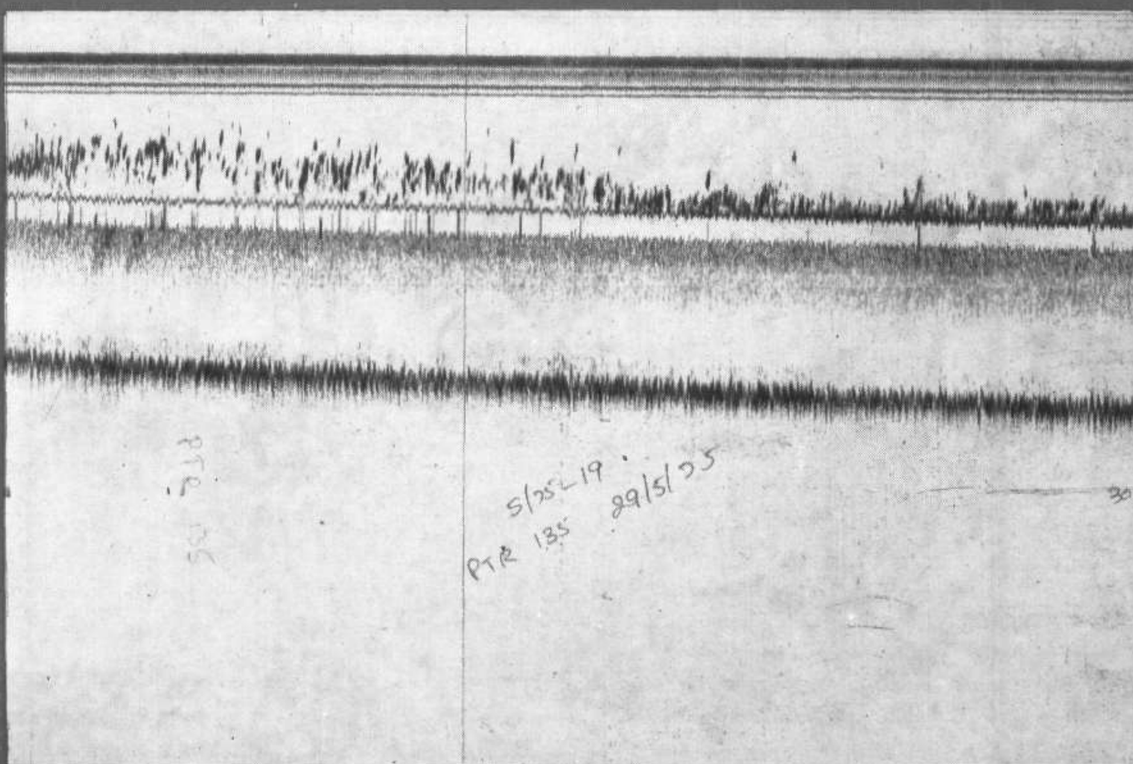
MARINE FISHERIES INFORMATION SERVICE



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THE MARINE FISHERIES INFORMATION SERVICE: Technical and Extension Series envisages the rapid dissemination of information on marine and brackish water fishery resources and allied data available with the Fishery Data Centre and the Research Divisions of the Institute, results of proven researches for transfer of technology to the fish farmers and industry and of other relevant information needed for Research and Development efforts in the marine fisheries sector.

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CONTENTS

PREFACE

Underwater acoustics has in the present day context multifarious uses and the development in this field has been most rapid during the last few decades. A major area where underwater acoustics has been gaining importance has been in the field of marine fisheries. The techniques in acoustics have developed to such an extent that we could today detect fish and fishing grounds, identify even fish components, and quantify their resources. Echo sounders have enabled the study of the little known Deep Scattering Layer and plankton distribution in more detail than it has hitherto been possible.

In India acoustic surveys for fishery resources have been first carried out during the cruises of *R. V. Varuna* of the erstwhile Indo-Norwegian Project. At present most of the larger vessels operating in Indian waters are equipped with echo sounders and sonar (ASDIC). The lead article in this number is specially brought out to highlight the role of acoustic aids in fish detection and explain in general the principles and functioning of the echo sounders and sonars with relevant tips useful in their operation. It is hoped that this would serve as an useful introduction to the subject and also help skippers of fishing vessels and others interested in using acoustic instrumentation as a fishing aid.

E. G. SILAS, Director, C.M.F.R.I.

Cover photo: A typical echogram of a mixture of golden scad and silver bellies from the inshore waters of the southwest coast of India.

ECHO LOCATION OF FISH*

Introduction

Fishing in the sea in olden days was more like hunting on land. However, over the years, developments in the art and practice of fishing brought forth improved crafts, gears and fishing aids enabling more fish to be caught with less of effort. One of the most significant developments in recent times in the sphere of fishing has been the introduction and use of acoustics in fishing operations. From merely finding the depth of fishing grounds with echo sounders, sophisticated acoustic instruments now aid in the location of fish schools, their identification as well as quantification. As the world's fishing fleets are constantly increasing in number and size, the fish finding instruments on board fishing vessels have become more advanced in presentation of information and also more complicated in operation. Most of these developments in the application of acoustics in fisheries happened during the past few decades. The use of these instruments by fishery scientists has only recently become common.

Properties of sound and principles of echo sounding

Sound may be defined as the transfer of energy through a compressible medium by means of small oscillations or vibrations of individual particles of the medium and is recognised as the periodic variation of pressure in the medium. Sound needs a medium to travel and cannot do so in vacuum. In sound propagation it is energy that is transported, not mass.

In acoustic parlance the number of oscillations or sound waves produced in one second is termed 'frequency' (C/S). It is also indicated by the abbreviated expression Hz. The human ear can sense oscillations between 20 and 20,000 C/S. Oscillations that have frequency of more than 20,000 C/S which human ear do not hear are termed ultrasonic. In echo sounding techniques ultrasonic sound frequencies are chiefly used.

In water, sound is propagated more quickly (1,500 m/second) than in air (344 m/second). Speed of sound in sea water is influenced by the salinity, pressure and temperature, the latter having the most dominant influence. Speed increases with increase in these parameters. The distance covered by one cycle of oscillation given in m or cm is termed wave length.

The property of sound waves reflecting back when they hit another medium, different from the one in which they travel is 'echoing'. The echoes are heard after a time lapse equal to the time taken by the sound to travel to and back from this medium or object. The distance of the object which echoed the sound can be calculated, knowing the speed of sound per unit time in the medium. It is also possible to quantify the returned echoes and assess the biomass of the object with an echo integrator. In the sea, living objects like fish, plankton and other organisms as well as the bottom of the sea reflect the sounds and by tracing these echoes through shipboard instruments they can be accurately located.

The echo sounder

Even though the term 'sonar' (Sound Navigation and Ranging) can in general be applied for the apparatus used for detection of underwater targets by means of transmitted sounds and returned echoes, a sonar system that transmits sound vertically is called an 'Echo sounder' and one that transmits horizontally is more typically known as 'sonar'. An 'active' sonar system involves transmission of sound and receiving of echoes while a 'passive' sonar system only receives sounds generated by underwater objects or other sources of transmission.

A typical echo sounder consists of display unit, transmitter, transducer and receiver (Fig. 1). A cabinet, usually located in the wheel house of the ship, contains the display unit, transmitter and the receiver. The transducer is fitted under the hull of the ship. The display unit is the brain of the echo sounder because it triggers the transmitter, and records the transmitted pulse as well as the received echo.

* Prepared by S. Natarajan, K. C. George and V. N. Bande.

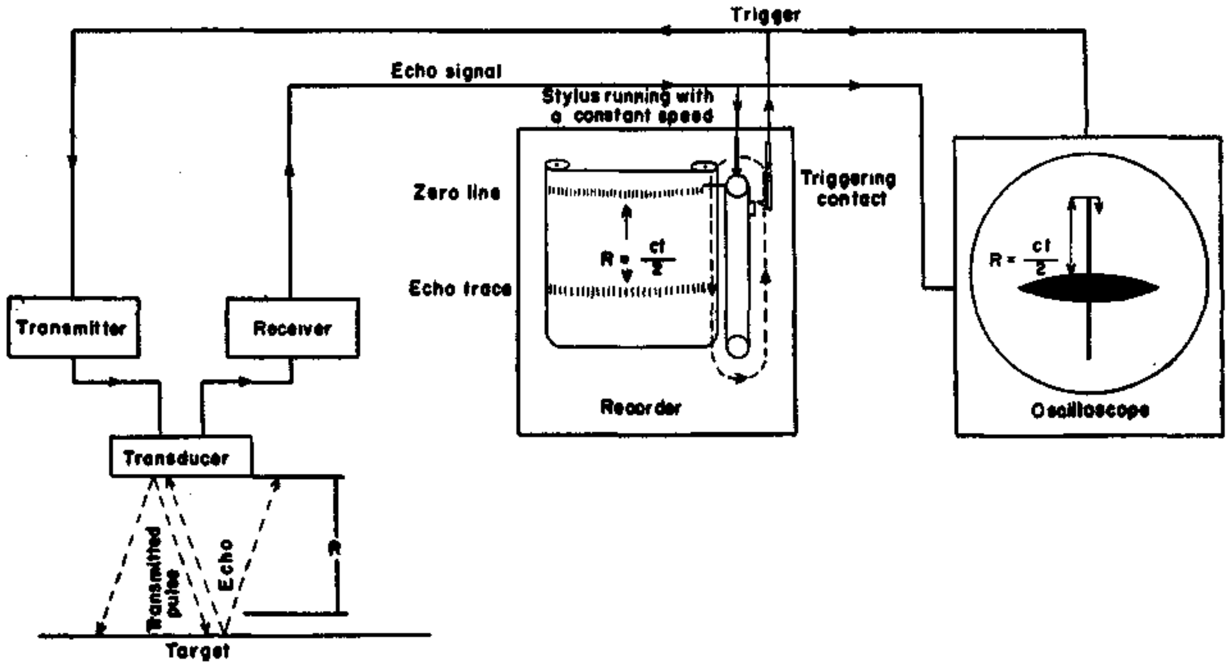

Fig. 1. Block diagram of the functional units of an echo sounder.
R=Range in m; c=speed of sound in water in m/sec; t=time taken in seconds by the sound wave to travel to and fro.

The display unit may be an electric motor driving a mechanical system for marking on paper, called recorder or an electronic circuit controlling the speed at which a spot of light travels across the face of a cathode ray tube (CRT), with deflection or intensity modulation facility. At one point on its travel the stylus arm on the mechanised system or the spot on the cathode ray tube will pass the zero mark on the depth range scale and at this instant the transmitter is switched on by the trigger and its energy is released to the transducer at the hull of the ship. The transducer converts the electrical energy into acoustic energy which is propagated through the water. In modern equipments the same transducer receives the echo from the objects or sea bed and converts the acoustic signals to electrical signals. This echo signal is amplified by the receiver and fed to the display unit which records the echo on paper recorder or gives an echo picture on the oscilloscope.

Structurally a commonly used transducer is a pile of laminates of feromagnetic substances such as nickel or nickel-like alloys. These are termed 'magnetostrictive' transducers. Such transducers are used for low frequencies upto 100 kHz. In high frequency 'Electrostrictive' transducers, other materials like Barium titanate and Lead zirconate titanate are used. 'Piezoelectric' transducers like those made of quartz crystals are based on the piezoelectric effect. The conventional magnetostrictive transducer of echo sounder is about the size of 10x20 cm and the size selected depends upon the required power output and wave length of sound transmission and usually not greater than 30x30 cm. Transducer mounting position on the hull is selected so as to avoid extraneous disturbances like propeller noise, air bubble interference etc. and is usually fitted in the anterior third of the hull.

Operating controls of the echo sounder

It is essential for the user to know the effect of the various operating controls and their settings for the proper operation of the equipment. Important conventional controls of the echo sounder are described below:

Power and illumination switch: This switch connects the appropriate power supply to the control cabinet. The intensity of illumination can be varied as per requirement.

Range switch: The effective range of operation is determined by the range switch, which has two modes of selection in the advanced models. One is basic range and the other is phased range. Basic range is used to search the full column of water to its effective range, eg. 0 to 50 m, 0 to 100 m etc.; whereas phased range is used when the top layer is not required to be searched and when only the deeper water is to be searched eg. 40 to 90 m, 80 to 180 m etc.

Transducer selector or beam width selector switch: This facilitates the selection of one transducer or the other when more than one of different sizes or one transducer with double beam is fitted. This enables the user to select the appropriate width of the beam to be radiated. (Beam width of transducer is the angle between two points in a power polar diagram (intensity) where the intensity falls to half of its maximum value (3 dB) as shown in Fig. 2. It is the measure of the directivity of the transducer).

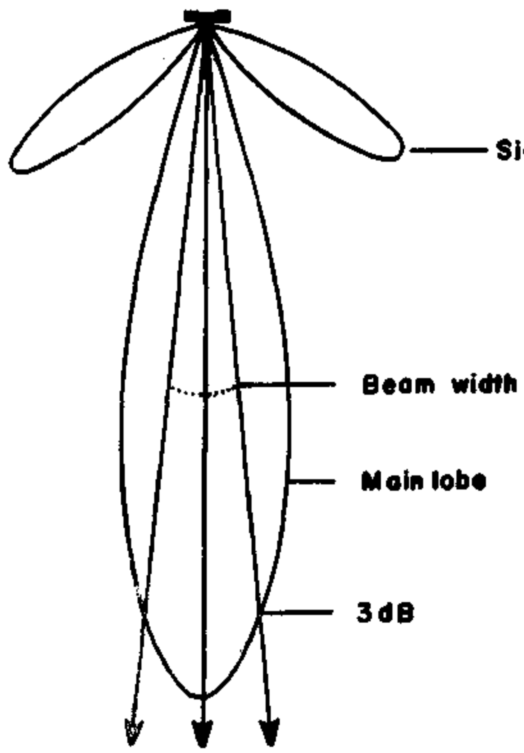

Fig. 2. Diagram showing directivity of the sound beam.

Mode selector: The number of modes of operation may vary depending upon the type of equipment. However, there can be minimum two modes of operations, namely White line or Dynaline and Contour line. When White line mode is selected a narrow belt of white area below the bottom line is formed. When contour line is selected, the area below the bottom line will be white all the way for the rest of the paper.

Pulse length and band width selector: This would enable the user to select the pulse length of the transmission. Normally narrow (short) pulse length and wide band width are selected for shallow waters and wide (long) pulse length and narrow band width are used for searching deeper waters. (The pulse length or pulse width (T) is the time duration during which the transmission takes place or in general it is the time between the leading edge and the trailing edge of the pulse termed in micro/milli second).

Output power control: This enables the user to transmit with full power or reduced power. While using the equipment in deep water, full power is selected and in shallow water reduced power is used. Peak power (PP) is the maximum instantaneous power transmitted during one pulse, expressed in kilo watts and average power is the power transmitted during one second in watts, which is always less than peak power.

Receiver gain control: This controls the amplification of the echoes received. When turned clockwise fully, echoes from temperature layer, plankton. and random noise signals are also recorded on the echogram paper. Hence it must be critically adjusted so as to have the clear recording of only the useful echoes, ie. of the fish.

Recorder gain control: Also called recording intensity control will control the degree of blackness of the echogram. This does not have any effect on the sensitivity of the receiver and is so adjusted that the weakest echo can be recorded, at the same time avoiding excessive paper residues.

T. V. G. control: The 'Time Varied Gain' of the receiver is controlled by this. The TVG function will give equal strength of echo signal for the similar targets, irrespective of the distance of the target.

Discriminator or sensitivity control: The signal strength necessary to produce the white line effect, which will differentiate the bottom fish echoes from those of sea bottom is regulated by this control. Normally it is set higher to obtain a stable white line. Relatively low discriminator setting will produce a "broken white line" when the bottom conditions change from hard to soft and again soft to hard, causing a change in the signal strength. If too high a discrimination is set, even a dense school also will produce white line. Hence a critical adjustment is warranted.

Line density control: This controls the speed of the recording paper. When the speed is increased the echo picture is elongated and when decreased the picture is compressed. To economise the consumption of the paper, a reduced paper speed is selected.

Marker switch: When this is pressed, a line appears on the recording paper as a reference, for later identification of events.

Recording threshold control: This control enables the user to fix a threshold for isolating the required echoes efficiently from noise and unwanted weak signals. While setting the control care must be taken to avoid the loss of useful echo signals.

The Sonar

Most features of vertical echo sounders apply to the horizontal echo-ranging sonar. The block diagram of the functional units of a sonar is given in Fig. 3. It is possible to receive the sonar echo as an audible tone and distinguish different types of echoes. With the horizontal echo ranging sonar the area covered by the search can be much greater than by the vertical echo sounder. The sonar usually cannot give much useful information on the seabed as it is recorded by a normally operated sonar only in relatively shallow waters. The appearance of fish records on the sonar will differ with the search programme. A normal programme is to search between about 60° to the port and starboard side of the ship, with sound emissions at every 5°. Modern instruments can be set for automatic search programmes. Traces are produced as the beam passes the schools in 5° steps. The same target may appear more times in the echo record depending on its distance from the ship and the range at which it was detected first. This type of search programme is thus not suitable for obtaining a count of the schools.

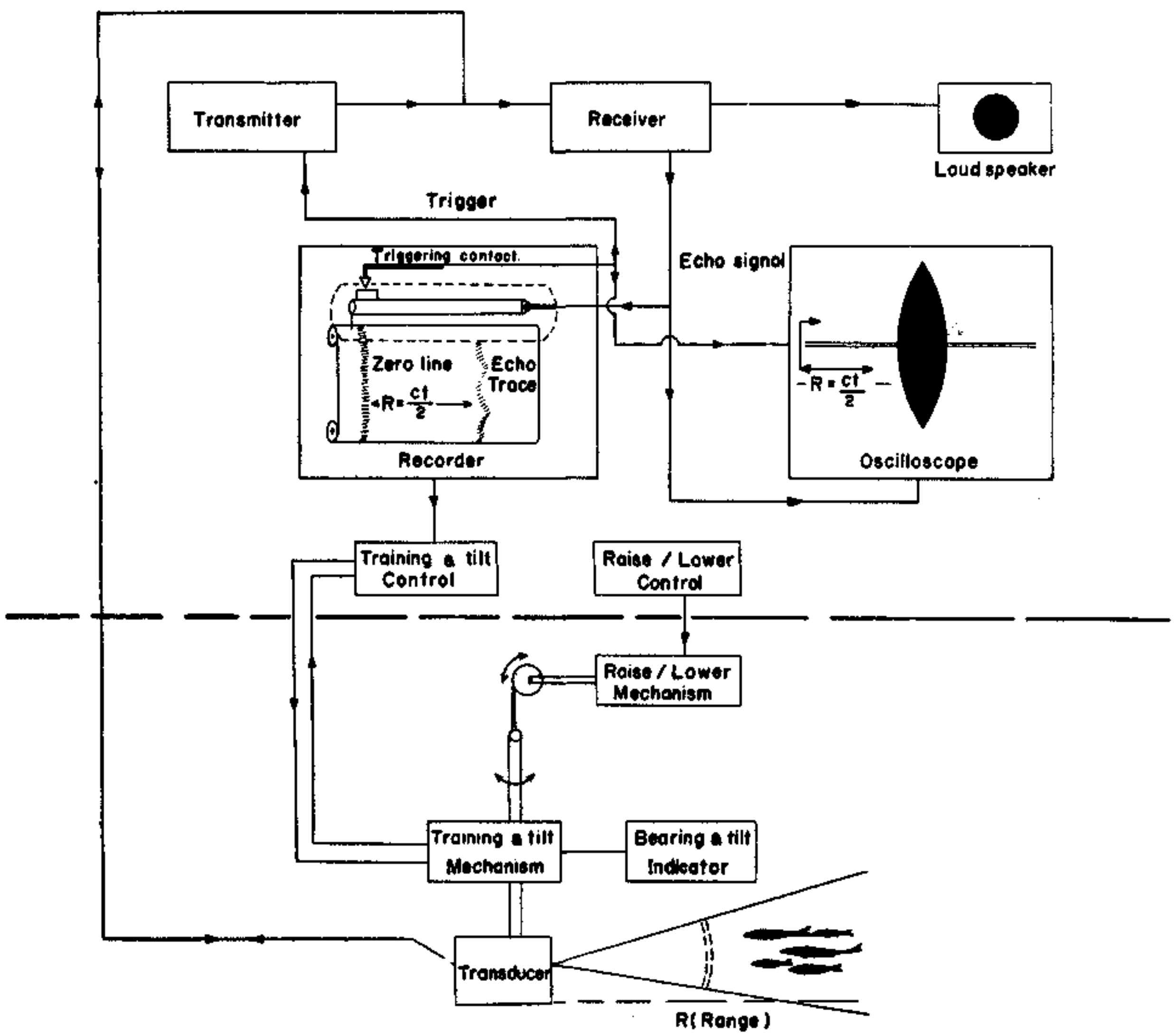

Fig. 3. Block diagram of the functional units of a sonar.

A survey programme commonly used for pelagic schooling fish is to have the transducer at a fixed angle of 45 to 90° to port or starboard. This will allow fairly good coverage.

Operating controls of Sonar

Many controls and their functions in the case of the sonar are similar to those of echo sounder. A few additional controls of modern sonars are explained below:

Hoist lower switch: The switch lowers the transducer of the sonar for search and hoist it up when not used. Normally the transducer is hoisted so that the speed of the vessel may not be reduced.

Tilt control: This is used either to search the school on the surface by tilting the transducer upward or to search the fish school in deeper water, by tilting it downwards. Also when the sound wave is bent due to thermocline effect, an effective range of sonar can be had by tilting the beam accordingly. Tilt angle is indicated by the tilt indicator.

Training control: By using this control the transducer can be rotated along 360°. When continuous training is required the control can be put in 'automatic', otherwise in manual position. This is operated by watching the bearing indicator.

Training speed control: The speed of the movement of the transducer, while training could be varied by this. When it is required to change the position of the transducer quickly, the speed control may be varied in clockwise direction.

Sector control: The sector to be scanned can be selected either from 0 to 90° port by the outer knob or 0 to 90° starboard by the inner knob of this control. The minimum search selector width is approximately 8° in SIMARD S.U. Sonar. This may differ for other types of equipments.

Programme selector: This selects either manual or automatic programmes. In manual position the transducer is trained manually. Search and catch are the two programmes in automatic. When put to search the transducer trains step-wise at 3°, 5° or 8° depending on the step angle control. When put to catch programme the transducer trains continuously. Search programme is used while searching for schools. Catch programme is used when the vessel is close to the school.

Audio Volume Control: This control varies the receiver output signal given to the loud speaker which gives an audible note of the echo received. Experienced Sonar operator can identify the type of object from the sound heard.

Some other common technical terms related to acoustic equipments are:

Receiver gain: It is the ratio of the output to the input signal of a receiver amplifier.

Receiver Band Width: It is the range of frequency at which the receiver amplifier gain falls by 3 dB or to half of its maximum power at centre frequency or 0.707 times of its maximum voltage at the centre frequency. It is normally called as half power band width or 3 dB band width.

Source level (SL): It is the maximum sound pressure level of a source expressed in dB relative to 1 μ Bar (dB/1μ Bar) at a distance of 1 metre along the acoustic axis. It is the measure of the output of the transmitter.

Spreading loss: It is the reduction in the sound energy on propagation through medium due to the spherical spreading in the surrounding medium. This loss is directly proportional to the square of the distance.

Absorption loss: It is the reduction in the sound energy on propagation due to the dissipation in the medium. This loss is directly proportional to transmission frequency.

Two way transmission loss (TL): It is the total reduction in the sound energy on propagation due to spreading loss and absorption loss associated with echo ranging. In logarithmic form it is given as $40 \log R + 20 \alpha R$ where R is the range in metre α is the absorption co-efficient.

Target strength(Ts): It is defined as the ratio of the reflected sound intensity to the incident sound intensity at one metre away from the target expressed in dB. It is a measure of the reflecting properties of the target.

Echo records

Build up of a fish mark in an echo sounder: When a ship operating an echosounder passes over a fish the leading edge of the sound beam first hits the fish and a recording occurs which is not the correct depth position of the fish. Only when the vessel is directly over the fish the correct depth is measured. After the ship has passed over the fish the trailing edge again hits the fish and the characteristic inverted 'V' shape recording is produced (Fig. 4). 'M' shaped marks indicate that the fish has moved inside the main beam,

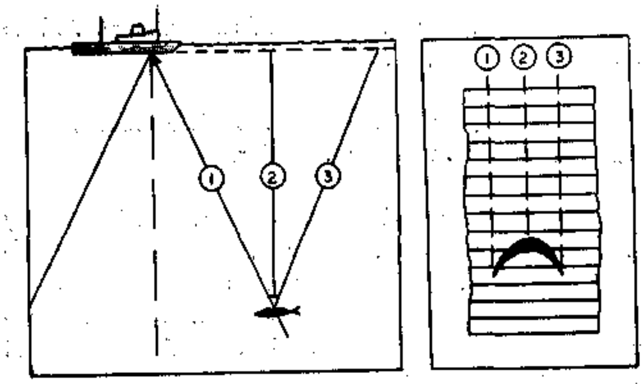

Fig. 4. Diagramatic representation of the build up of a fish echo mark.

most probably swimming in the same direction as the vessel; when the inverted 'V' is incomplete, it may indicate that the fish has left its position rapidly.

Double echo

The seabed can cause a confusing echo called second seabed or 'double echo'. The ground reflects a very large area of sound beam towards the transducer. A great deal of the sound will strike the water surface around the vessel which acts as a reflector. This causes the waves to return to seabed which again reflects the sound back to the vessel marking the paper at exactly twice the actual depth.

Angular definition

If the vessel is sailing over a trench in the seabed and the area covered by the main lobe of sound beam is wider than the trench, the transmitted pulse will be reflected first from the edges of the trench and received before the reflections of the bottom of the trench. This will result in a straight line recording because the bottom reflections which arrive later will be masked by the reflections of the edges. Similarly the echo mark of any fish in the trench also is lost (Fig. 5a). Therefore, a trawl may be damaged easily on what falsely appears to be a flat bottom. However, this can be overcome by using a narrow beam width. This ability of the sounder is called angular definition. When trawling on a slope, the beam edge hits the bottom before the centre of the beam hits the fish, resulting in no fish mark (Fig. 5b).

General characteristics of fish echo records

Fish echo records may show individual specimens separately or echoes from 2 or more fish may overlap to form a multiple echo. With the vessel lying stationary single fish will be recorded as continuous line traces. At slow speed the lines shorten and become curved and at high speeds they appear as dots or points. The reason for this is that the number of echoes obtained from each individual decreases as it is swept by the sound beam within a shorter time. The beam angle in the ship's direction of travel will also influence the appearance of single fish traces, the wider the beam the longer the individual traces.

When the fish density exceeds the limit of the power of resolution of the echo sounder used, the records take the form of multiple echo trace which may appear as a layer or as a distinct solid trace. The usual feature of the layer type traces often produced

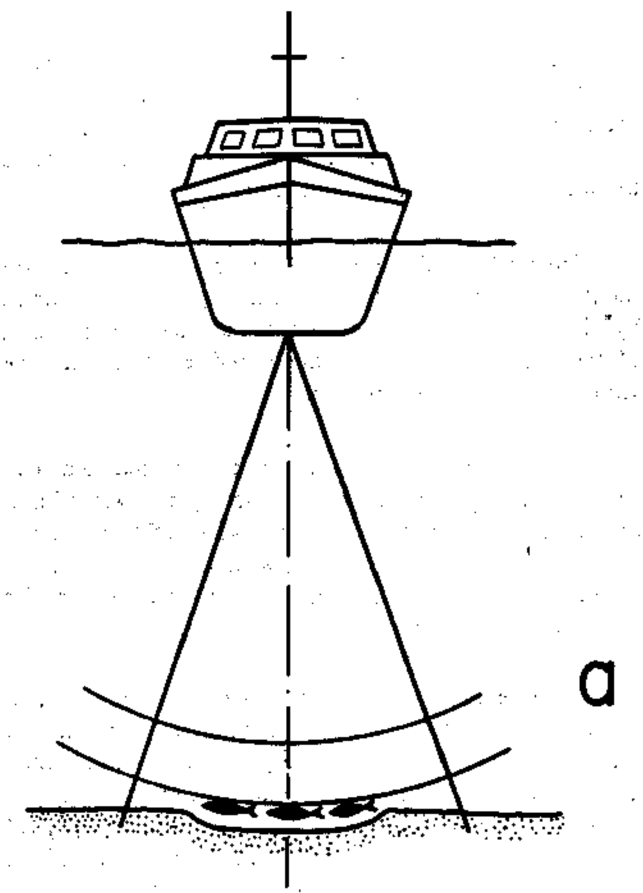

Fig. 5a. Diagram showing fish not hit by sound beam due to trench.

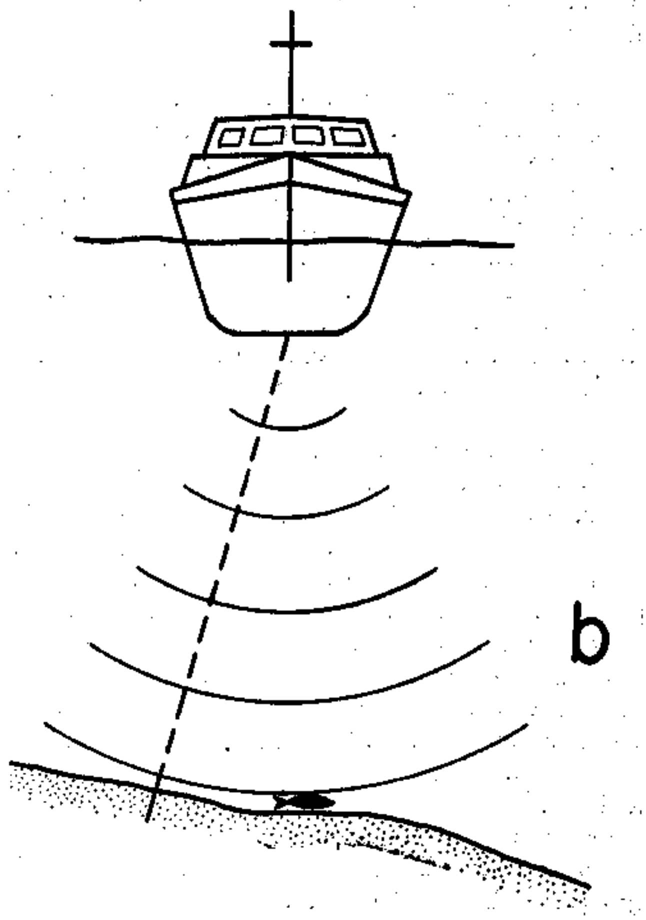

Fig. 5b. Diagram showing fish not hit by sound beam due to sloping ground.

by fish, is the presence of single fish traces at the upper and lower boarders of the layer. This feature can be used for distinguishing layer traces produced by fish and from those of smaller organisms like plankton.

Echo records produced by smaller organisms such as fish larvae and plankton appear as fine grained clouds and are often recorded over large areas. Character of these traces does not change with the change in speed of vessel.

Fish recording near the bottom-dead field

Fish very close to seabed are difficult to detect because of the 'dead field' in the sound beam close to the seabed (Fig. 5c). If the bottom is uneven the extent of the 'dead field' increases. This happens also with wider beam width. However, if the fish is off the bottom, recording of fish will be indicated (Fig. 5d).

Spurious echo records

Background noise of electric or acoustic origin, propellor noise, noise from the wake of passing ships etc. disturb normal echo records. An important type of interference is the side lobe echo produced from a steeply sloping seabed. Sounds of biological origin traced to mostly marine mammals get recorded on acoustic instruments. Air bubbles in the water immediately under the transducer caused by heavy pitching of the vessel also give disturbed echo records.

There are a number of disturbing 'non fish' records peculiar to the Sonar. Since signals in most sonar sets are also presented as audible sounds, certain kinds of under water sounds may be heard. Propellor noise is one of these. In rough sea with big breakers, air bubbles in the water may cause the Sonar beam to be reflected. So also records of wakes of passing ships may be mistaken for fish schools.

Echoes from small sound scatters in the sea appear as small dots and dashes. Large vertical or horizontal temperature gradients in the sea may give stratified echo records. There may also be interference from other acoustic instruments of the same vessel or of other vessels operating nearby.

The echo records can also give some details of the seabed, like hardness, softness, terrain etc. Soft ground gives weak echoes, whereas hard bottom will

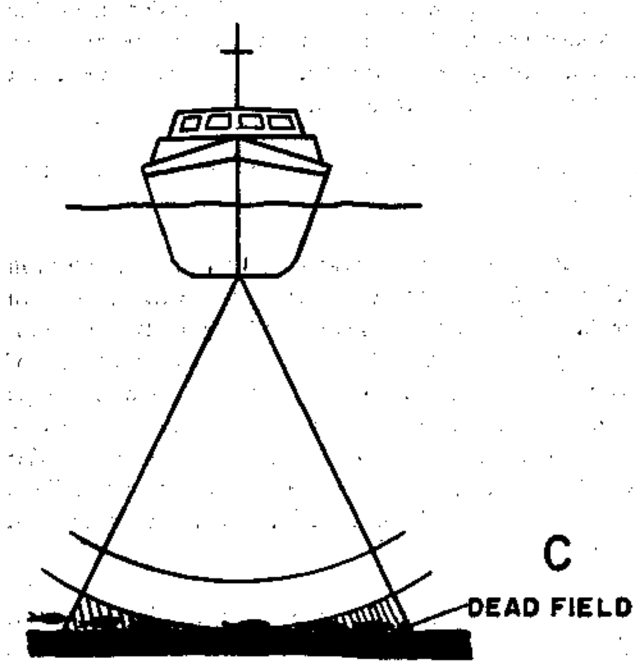

Fig. 5c. Diagram showing the fish hidden from sound beam (dead field) due to their being very close to the bottom.

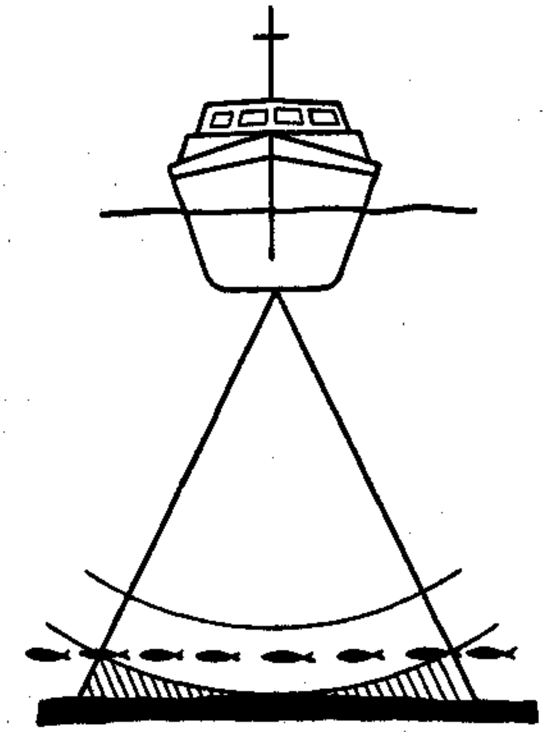

Fig. 5d. Diagram showing the fish off the bottom not hidden from the sound beam.

give strong echoes which usually rebound to give double echoes. In shallow waters also several echoes may be obtained from the seabed.

When using a sensitive Echo Sounder in depths of water beyond the depth scale set on the recorder, the seabed may be recorded at an incorrect scale and a 'Ghost bottom' may appear.

Echo location and surveys for fish resources in Indian waters

Use of echo sounders and sonars for fish detection and scientific studies in Indian waters was initiated in the late fifties by the vessels of the erstwhile Indo-Norwegian Project. Typical echogram patterns of some of the important commercial species and groups have been available from these studies. These echograms relate to the Simrad Scientific Echo Sounder EK–S system. Location of the *Kalava* grounds off the south west coast of India was largely aided by acoustic instruments.

Extensive surveys for the important fish resources of the south-west coast of India were carried out by the Pelagic Fishery Project from 1971 to 1978. These surveys using echosounder, sonar and echo integrator estimated the biomass of the standing stocks of different fish resources.

Major fish resources amenable to acoustic surveys using echosounder and echo integrator in Indian waters are the column fishes such as white baits, cat fish, ribbon fish and horse mackerel. In the case of mainly surface schooling fishes such as oil-sardine and the Indian mackerel sonar surveys have been found to be the more suitable acoustic technique for location and quantification. Biomass of benthic species such as prawns and lobsters cannot easily be estimated using the present acoustic instruments and techniques.

During the repeated acoustic surveys along the south west coast it has been possible to have some typical echograms of schooling fishes. The identity of the fish referred to particular echogram type has been confirmed by several fishing operations. The profiles and configurations of the echograms are basically governed by the size of the fish, their sound reflection, properties and schooling behaviour. However, instrument characteristics, their settings and the vessel speed are also vital factors influencing the shape of the echograms. The quick surveys of extensive areas and charting the density distribution of several of these resources have been possible mainly due to the clear identification of the echograms of different groups of fishes. The characteristic types of echograms referable to fishes such as oil sardine, white bait, cat fish, ribbon fish, horse mackerel as well as plankton are given in figures 6 to 11. These echograms have been recorded on dry paper with SIMRAD EK 120 echosounder through an EX recorder.

Looking at these echograms it will be seen that the echogram of the plankton is characteristically different in being evenly distributed fine dots and dashes, some times forming continous band-like profiles for long distances (Fig. 6). The echogram of cat fishes which are relatively large sized and positioned at some distance from each other while schooling, looks like inverted 'V' figures spread more or less evenly (Fig. 7). Large ribbon fishes also give inverted 'V' patterns, but on the whole more compact and straight vertical configurations (Fig. 8). The echograms of horse mackerel schools are typically straight and narrow stick like vertically disposed patterns (Fig. 9). The white baits disperse in the entire water column during the night (Fig. 10a), but form compact schools during the day (Fig. 10b). The dominantly surface schooling fishes like oil-sardine and mackerel do now and then come under the range of the echosounder. The echogram of the oil sardine appear as dense

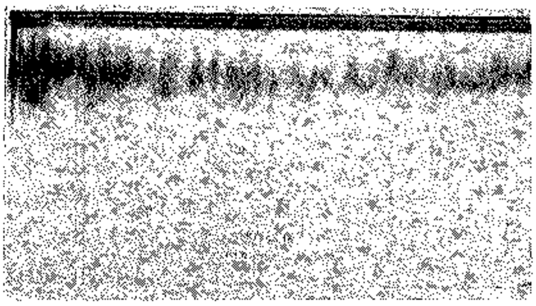

Fig. 6. Echogram of plankton.

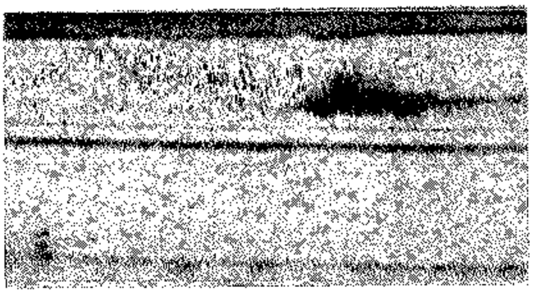

Fig. 7. Echogram of cat fish.

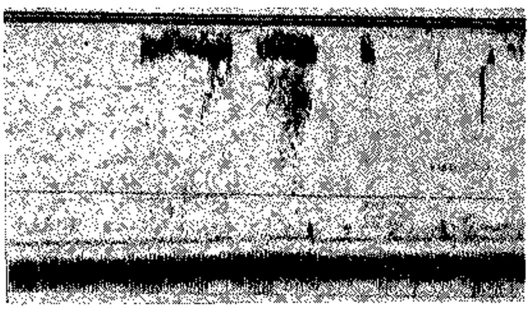

Fig. 8. Echogram of ribbon fish.

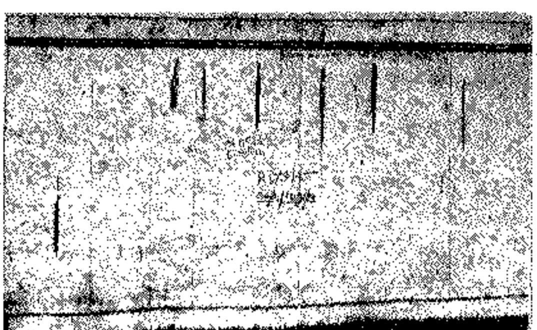

Fig. 9. Echogram of horse mackerel schools.

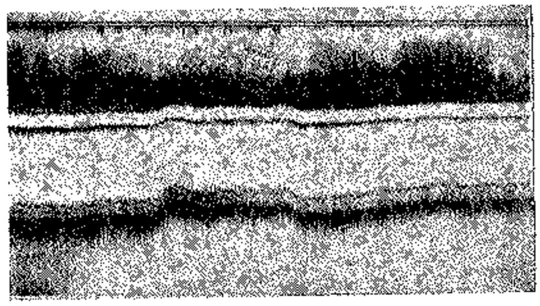

Fig. 10a. Echogram of white baits, night.

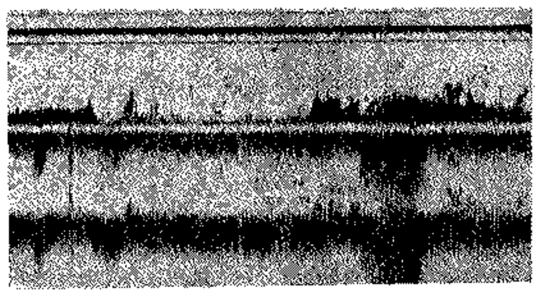

Fig. 10b. Echogram of white baits, day.

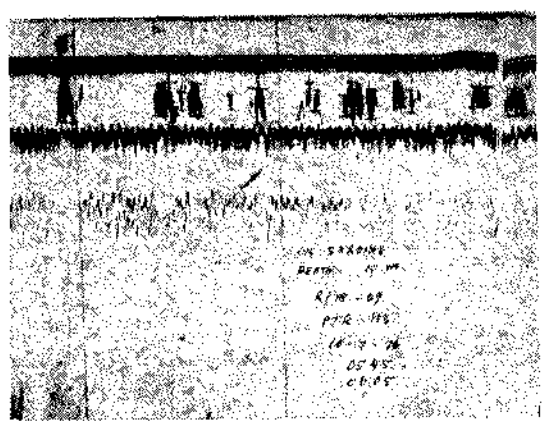

Fig. 11. Echogram of oil sardine schools.

patches which indicate closely packed fish in medium and large schools (Fig. 11).

The biomass estimates have indicated under-exploitation of several resources. Particularly it has been highlighted that the resources of whitebaits, horse mackerel and cat fishes are only marginally exploited and that there is immense scope for increasing the catches of these resources.

Apart from the estimates of the standing stocks of these resources, their distribution patterns in time and space could also be brought out by these surveys. It was pointed out that a large segment of the resources of horse mackerel, cat fish and white bait are over the midshelf beyond the present limits of their traditional fisheries. The best school concentrations of horse mackerel have been noticed beyond the 30 m depth contour. High levels of abundance of this fish have been observed for longer periods off the coasts of Kerala and south Tamilnadu and for shorter duration off Karnataka and southern Maharashtra.

The cat fishes and ribbon fishes have been located in good quantities in waters 20 to 80 m depths, particularly during the monsoon months between Cape Comorin and Honavar. The characteristic migration of a large population of white bait to the south-east coast during the June-September period and their concentration in the gulf of Mannar have been revealed by the acoustic surveys.

The use of acoustic technology in modern fishing and fisheries research is becoming more relevant in developing countries due to its proven advantages. The technology is being continuously developed to obtain more precise results. However, large scale production of the common units like echosounders and sonars at economic prices only will make their use popular.

Points to be remembered while operating echosounders and sonars

1. Select the high operating frequency of the sounder in shallow waters and low operating frequency in deeper waters.
2. Short pulse length would give better vertical resolution of the echoes.
3. When greater depth is to be covered, select long pulse length and narrow band width.
4. Select short pulse length and wide band-width while searching shallow waters.
5. Choose narrow beam width for better horizontal resolution of the echoes and wide beam width to cover more volume of water.
6. When only general information is needed reduced paper speed would economise on recording paper. Higher paper speed would have enlarged picture (horizontally) of the echo mark.
7. A lower depth range will be enough while searching shallow water, so as to get enlarged vertical view of the echo picture (now pen speed is automatically increased) and higher depth range for searching deep water (now pen speed is reduced).
8. Increase the recorder gain to get a clear mark of the weakest echo signal from deep water but reduce the gain to avoid the unwanted noise echo from shallow water.
9. Use phased ranges to search deeper water, so as to get enlarged picture of the echo from the searched column.
10. White line facility may be used during bottom trawling to distinguish fish echoes from the bottom.
11. TVG will be useful when the echo sounder is set for fish finding.
12. Use Contour line recording if available, for navigation.
13. While judging the size of the school from the recording, consider the speed of the vessel, speed of the paper or line densities and the range selected.
14. In calculating the actual depth of the school from the surface, measure from the top of the echo picture and add the depth of the transducer from the surface of the water as the depth recorded denotes only the distance of the school from the transducer.
15. Do not use too much receiver and recorder gain as this blackens the whole recording paper even with weak extraneous noise signals, creating difficulty in distinguishing the noise and echo.
16. The downward tilt of transducer should not be used while using the sonar at shallow water to avoid the bottom echo marks in the recording paper.

PRAWN CULTURE PROVED HIGHLY PROFITABLE IN PONDICHERRY*

A natural small pond formed by tidal effect of the sea (Coramandal Coast) near Moorthikuppam-Puthukuppam village, about 21 km south of Pondicherry was selected for an experiment in commercial prawn culture. The pond with muddy bottom is about 1 acre in area and situated adjoining Uppanar river which is a branch of Ponniar river. Initially natural stocking was carried out by letting in water from the river at high tide through the sluice gate provided for the pond. In addition 5,000 prawn seeds of species *Penaeus semisulcatus, P. indicus* and *P. monodon* were also collected and stocked in the pond on December 12, 1979.

The water in the pond was maintained at a level of about 1 m depth. Manuring with 500 kg of cow dung was carried out in the pond towards the beginning of the experiment. The culture was maintained for 80 days by which time the river mouth was closed. Due to lack of tidal inflow and replenishment of the water, considerable increase in temperature and salinity of the water to 30°C and 31‰ respectively was noticed. Mortality of some prawns also occurred. As it was evident that the stock could not be retained any further, the prawns were harvested on completion of 80 days of culture on March 3, 1980. 330 kg of prawns (Figs. 1& 2), 200 kg of fishes and 50 kg of crabs were obtained by the final harvesting, realising a net profit of Rs. 10,860/- from natural as will as intensive stocking. Details of expenditure and income are given in Table 1. Since a pond which was in existence and used for prawn culture by natural stocking was used for the experiment, no expenses for the preparation of the pond are included in the cost economics.

*Prepared by L. Chidambaram, C.M F.R.I.

Table 1. *Income and expenditure account of the prawn culture experiment at Pondicherry.*

Expenditure	(Rs)	Value realised	(Rs)
Cost of seed	140.00	*P. semisulcatus* -180 kg	
Manuring	200.00	(18-22 count) @ Rs 50/kg	9,000
Watchman	900.00	*P. monodon* -20 kg	
Harvesting	300.00	(20 count) @ Rs 50/kg	1,000
Total	1540.00	*P. indicus* 130 kg	
		(60 count) @ Rs 15/kg	1,950
		Fishes 200 kg	400
		Crabs 50 kg	50
		Total	12,400
Net profit	12,400—1540 =		10,860

The experiment is the first of its kind in Pondicherry state. The encouraging results would show that there is considerable scope for expansion of prawn culture in this area. The culture work was carried out by Thiru C. Narayanaswamy, a fisherman by profession and a panchayat leader, who has undergone training in prawn culture at Madras Research Centre of CMFRI. The experiment was carried out under the technical guidance of Thiru L. Chidambaram of CMFRI and Thiru N. E. Kirubakaran Paul, Regional Inspector of Fisheries of Pondicherry. Based on the results obtained, action has been initiated to bring several acres of adjacent areas under intensive prawn culture.

NEWS—INDIA AND OVERSEAS

Rapid test for chlorine content developed

In the Central Institute of Fisheries Technology at Cochin a rapid calorimetric test using a reagent-impregnated filter paper has been developed to measure chlorine content. This would greatly help processing factories to adjust the chlorine content of the water they use.

Easing the jelly fish sting

Jelly fish sting is often a nasty experience for the fishermen. For getting relief from these stings John P. Doyle of the University of Alaska has some helpful suggestions. The stinging cells (nematocysts) are located in the tentacles which the jelly fish use for catching food. When these cells are irritated, they discharge a tube stinger into the skin with an acid toxin protein.

According to Doyle, since it is an acid protein it can be neutralised by a base or protein digester. Baking soda and antacid tablets or liquids have been found to give relief. Even unseasoned meat tenderiser may be used, as it is a protein destroying compound that will destroy the toxin. The tenderiser can be dissolved in sea water and applied to the affected area.

Petrol and ammonia may also be used. But, as they are both skin irritants these should be used only when nothing else is available. In the case of ammonia it should be diluted.

FNI 18 (8): August 1979

South Pacific giant clam in danger

The giant clam of the family Tridacdidae is an important traditional resource in the South Pacific. For the past hundreds of years it has been taken from exposed reef flats at low tide and also harvested by diving in depths down to 50 m. But in recent years the clams have been getting scarcer. Increased pressure on them through modern harvesting methods such as Scuba diving has contributed to their depletion.

In Tonga, one of the South Pacific islands, the giant clam provides nearly 40 per cent of marine resources. One development contributing to the decline of stocks has been the demand for clam meat as a delicacy in the restaurants in Australia and New Zealand, resulting in indiscriminate stripping of isolated reefs to supply this market. The Tonga Fisheries Department sought assistance to study the resource position and to work out management regulations. A scientist from New Zealand is at present working on this project under the Bilateral Aid Programme to Pacific Islands.

The problem is not confined to the small island states alone. Off the Queensland coast of Australia, for example, Taiwanese vessels have denuded some of the atolls almost to the point of resource extinction.

FNI 18 (8): August 1979

Sri Lanka bans lobster exports

Spiny lobsters, threatened by overfishing, are among the species which the Government of Sri Lanka has banned for export.

FAO experts and local fishery biologists have repeatedly warned that unless stringent conservation measures are implemented along the coastal belt, a number of varieties of these lobsters would become extinct within the next few years. With the high price paid around the world for lobster tails, enforcement of quotas or other controls is extremely difficult. Last year the government banned the use of spears or spear guns for fishing the lobsters with a view to limit the fishery.

FNI 18 (10): October 1979.

Asian Development Bank in business

Since it began business in late 1966, the Manila-based Asian Development Bank has provided nearly US 220 million dollars in loans for fisheries projects for developing member countries. But this is seen as only a beginning if the fishery needs of the vast Asian and South Pacific region are to be fulfilled.

Like all other development agencies, national and multinational, the ADB is having a close look at the development needs of the countries in the light of the newly created 200 mile exclusive economic zones by assisting small scale fisheries, improving aquaculture techniques and providing better distribution of catches. Planning will, however, have to be on macro-scale levels if aid programmes are to get anywhere near the 10,000 million dollars which is FAO's estimate of the total fisheries investment requirement of the ADB's developing member countries for the next decade. For some of the countries involved the 200 mile limits have brought control over large fishing areas and for others such as Thailand and South Korea they have cut into grounds opened up for trawling fleets built up with development aid. Such contrasts emphasise the importance of broad and proper planning.

FNI 18 (10): October 1979

Errata — *Mar. Fish. Infor. Serv. T & E Ser. No.* 13 1979. Page 7 - Total annual catch of tunas in Lakshadweep during 1978 — 1,874 tonnes instead of 1,166 tonnes.

BOOKS

The Encyclopedia of Shells: Edited by S. Peter Dance. Blanford Press, Dorset, pp 288, Second Edition 1977.

This volume is the first reference work to combine comprehensive worldwide coverage of the sea shells along with colour photographs large enough to show details of surface pattern and texture. Over 2,000 species are arranged in systematic order according to an up-to-date classification of molluscs. A pictorial key is provided to assist the collector in identifying his specimens. Within genera the species are dealt with in alphabetical order. The colour photographs, over 1,500 in number, often include more than one specimen so that variation within the species or different aspects of its shell can be seen.

Leaving aside shells too small to attract the attention of amateur collector, the book covers the shells from warm and cold seas, with descriptions and illustrations for most of the commonly collected genera. As gastropod species outnumber bivalve species by five to one, this ratio is maintained in the book. Containing an introduction dealing with the biology, classification and zoogeoghraphy of molluscs and a bibliography, this volume is the most useful overall work of reference for the shell collector.

Remote sensing and image interpretation: By T. M. Lillesand and R. W. Kiefer, John Wiley & Sons. New York, pp 612, 1979.

The book, prepared primarily as an introductory course in remote sensing, illustrates its utility in a diverse range of data gathering application. Engineers, soil scientists, foresters, geologists, geographers, oceanographers, land planners, meteorologists, water resource managers, biologists or anyone involved in measuring, studying and managing earth resources should find it valuable both as a text book and as a reference.

In a broad introduction to the subject of remote sensing all the classical elements of aerial photographic interpretation and photogrammetry are described. The concepts of interpreting images from non photographic sensors, both visually and through the application of digital image processing techniques are introduced. The first half of the book concentrates on photographic remote sensing techniques, while the second half deals with the principles of acquiring and interpreting data collected by nonphotographic sensors. It should enable the student to understand with the image in hand the broader perspective of our earth, its resources and their environment.

Former Fisheries Director General of Norway Mr. Klaus Sunnanaa died in January, 1980 at the age of 74. Strong in his convictions and rooted in his experiences, he was a dynamic person of international vision. He overcame physical handicaps that would have daunted lesser men to rise to eminence in the Norwegian fishing industry and remain its leader and guide for 25 years. He is familiar in India with his association and support to the erstwhile Indo Norwegian Project right from its inception in Kerala, being the Fisheries Leader in the Project from August 1959 to September 1960. One of the large fishing vessels put in operation in Kerala waters by the project was named after him and is at present operating from the Cochin base.

Compiled and prepared by M. J. George, G. Subbaraju and C. Suseelan. Published by Dr. M. J. George, Senior Scientist on behalf of the Director, Central Marine Fisheries Research Institute, Cochin-682 018