

19 1965

ION  
NSINGTON  
NAL  
080116-14.01  
THLY SERVICE BULLETIN  
TERN AUSTRALIA. DEPT. OF  
Jan 1965  
MENT OF PARKS AND WILDLIFE

CALM LIBRARY ARCHIVE  
NOT FOR LOAN

DEPARTMENT OF FISHERIES AND FAUNA  
WESTERN AUSTRALIA  
MONTHLY SERVICE BULLETIN



Vol. XIV, No. 1

January, 1965

STAFF NOTES

Several new appointments to the field staff were made last month. We welcome Mr. G. Clifford, Mr. W.M. Mahoney and Mr. E.J. Little who commenced with us on December 7, 14 and 21, respectively. Mr. Clifford was appointed Inspector and has been posted to the p.v. "Dampier". Both Mr. Mahoney and Mr. Little were appointed Assistant Inspectors. Mr. Mahoney has been posted to the p.v. "Vlaming" and Mr. Little, for the time being, to the Perth Inspectorial District.

\* \* \*

Officers who commenced annual leave last month include Miss J.M. Wallis (Typist) on December 7, General Assistant C.R.C. Haynes (Fremantle), Mr. P.G. Yewers (Head Office) and Technical Officer E.H. Barker, on December 14. Mr. G. Dixon (Head Office) on December 16, and Miss V. Woods (Librarian) and Fauna Officer H.B. Shugg on December 29. Senior Research Officer B.K. Bowen will commence one week's annual leave on January 5. Fauna Warden S.W. Bowler will also commence annual leave on January 5.

AMENDMENT TO THE SUPERANNUATION  
FAMILY BENEFITS ACT

Advice has been received from the Secretary of The Superannuation Board that following a review of the provisions of the Act, amendments have been approved by Parliament to improve the conditions relating to membership of the Fund and, in certain cases, to the benefits payable under the Act. The principal features of the amendments were:-

1. The scale of available units has been increased from the previous maximum of 42 for a salary in excess of £4,160 per annum to a new maximum for a salary of £5,200 per annum or more. The amended scale from 42 units up to 50 units is now:-

<u>exceeds</u>	<u>Annual Salary</u>	<u>units available</u>	<u>exceeds</u>	<u>Annual Salary</u>	<u>units available</u>
4,160 -	4,290	42	4,810 -	4,940	47
4,290 -	4,420	43	4,940 -	5,070	48
4,420 -	4,500	44	5,070 -	5,200	49
4,500 -	4,680	45	5,200 -	-	50
4,680 -	4,810	46			

A contributor who is at present contributing for the maximum number of 42 units and would, by the extension of the above-mentioned scale be entitled to additional units, may elect for the additional units without the requirement of a medical certificate if the election is made within twelve months of the commencement of the 1964 Amendment Act.

2. Children's allowances to a widow have been increased from £1 per week to £1.10.0. per week and, in the cases of orphaned children, the allowance payable to the guardian of the children is increased to £2 per week for each child. Provision has also been made for the continuance of the payment of the child allowance beyond the age of 16 years to any age up to 21 years where a child is continuing full time studies at a school, college or university.

Where a contributor dies without leaving a widow but there are children involved, the child allowance is payable to the guardian. On cessation of benefits, any difference between the Fund share of the benefits paid on account of children and the total amount contributed to the Fund by the deceased father will be refunded to the children.

3. The provision whereby the amount of contributions paid by the State during any period of military service was deducted from a refund of contributions following resignation from the Service has been repealed.

4. Contributions of deceased contributors without dependants which are at present payable to their Estates at surrender value will, in future, be refunded in full together with interest.

5. A widow has been given the option of accepting a pension or, if she so prefers, she may obtain a refund of the contributions (plus interest thereon). The last

mentioned alternative will allow a widow to utilise the lump sum to discharge a mortgage on her home and thereafter live rent free. Her income could then be obtained from the Commonwealth, by way of Social Service widow's pension.

6. Under the previous provisions of the Act, a contributor who did not hold the maximum available units, could elect for additional units at any time prior to attaining his elected retiring age subject to the furnishing of a medical certificate that he is fit to continue his employment to his elected retiring age. Where a contributor has already ceased duty but has not attained the elected retiring age, units may be now increased without the medical certificate requirement.

7. On retirement on or after attaining the elected retiring age, pension benefits will be payable immediately. Previously, a contributor received the Fund proportion of the pension benefit during any period of leave for which he was paid as a retiring allowance and which extended beyond his elected retiring age. Under the amended provisions, the State will also pay its share of the benefit for the period concerned. The provision will have retrospective effect from January 1, 1964.

8. Where an employee became a contributor within 12 months of reaching his retiring age, previous provisions precluded the payment of any personal superannuation pension before the expiration of one year from the date of becoming a contributor. The new proposal will allow benefits to be paid on attaining the elected retiring age subject to the payment of the equivalent of one year's contributions.

9. A pension to a contributor's widow ceases on re-marriage. The new proposal will allow the resumption of benefits to such a widow if the husband of her re-marriage dies.

#### WHITE CRAYFISH PRODUCTION EXPECTED TO BE DOWN

Senior Inspector J.E. Munro says that there is every indication that the production of "white" crayfish this season will be down on last years figures. The run began fairly late and it was not until the end of the first week in December that substantial catches were landed. He had heard occasional reports of individual catches being better than last year, but generally the takes were less. Freezer boats also were not landing the same quantities of tails as last year. An

interesting report made by Inspector Munro was that a bag of "red" crayfish received in Perth for processing from Bunbury contained a predominance of large female crayfish. When processed, most of these crayfish showed signs of internal spawn.

Although catches were down the high prices being received by the fishermen could make the current season as remunerative as the last.

#### METROPOLITAN NEWS

Senior Inspector J.E. Munro reports that during the past year, fishing in the Swan and Canning Rivers was the worst he could remember. He attributes this to excessive fresh water caused by the cool seasonal conditions, heavy winter and early summer rains, the prevalence of speed boats on the rivers and the reclamation of netting grounds between Point Walter and Lucky Bay in the Swan River and at some places in the Canning River.

He says crabs are very scarce in both rivers and to his knowledge only a few small ones have been caught, and these in cobbler nets. Good sized prawns are fairly plentiful in the Canning River.

#### DONGARA JETTY TO BE IMPROVED

The Minister for Fisheries and Fauna (Mr. Ross Hutchinson) has been informed by his colleague, the Hon. G.P. Wild, Minister for Works, that improvements to the Dongara jetty will be put in hand in the near future.

Some fishermen using Dongara jetty have expressed concern that the existing facilities are either inadequate or else create a hazard both personally and to their boats, particularly when loading or unloading alongside in a heavy surge.

It is anticipated that the proposed improvements, listed hereunder, will facilitate the jetty's use by all sizes of fishing craft as well as obviate any possible hazards.

- (1) Working platform for servicing of fishing vessels on one end and two sides of berthing head. This will remove the hazard to personnel

by closing the open space between the fender system and jetty.

- (2) Increase the height of vertical fenders on the north side and increase the height of the low level platform by one foot.
- (3) Improvement to resilience of the south side fender system by the addition of three tractor tyres housed between the piles.

#### RECLASSIFICATION APPEAL RESULTS

The publication of the Government Gazette in connection with re-classification appeals in which the decisions of the Public Service Appeal Board were made known, just prior to Christmas was welcome news to both the Administrative Officer, Mr. B.R. Saville and the Fauna Officer, Mr. H.B. Shugg. Mr. Saville was reclassified from Class C-II-8 to C-II-9 and Mr. Shugg from Class C-II-4 to C-II-5/6. We offer them our sincerest congratulations.

#### SPEAR GUN EXPLOSIVE HEADS

As a result of a shark attack in Victorian waters recently, an underwater diver lost a leg. Considerable publicity was given to the incident, the Victorian newspaper stating that the use of explosive spear heads were legal in other States (i.e., other than Victoria) and that if explosive heads were legalized in that State such shark attacks could possibly be averted.

The implication that explosive spear heads are legal in Western Australia is not true. Although some use has been made of this type of spears in the past, the Commissioner of Police recently, in pursuance of his powers under the Firearms Act, 1931-1963, has now prohibited their use.

Furthermore the use of any explosive substance for the taking of fish is prohibited by the Fisheries Act - in fact any person using an explosive substance in Western Australian waters (e.g., for the destruction of underwater obstructions, oil search surveys, etc.) must first obtain the approval of the Minister.

CONVICTIONS

OCTOBER - DECEMBER, 1964

Date	Defendant	Court	Charge	Result
<u>FISHERIES ACT</u>				
2.11.64	DECEGLIE, Giovanni	Fremantle	U/W Craytails	<u>Fined</u> 283. 2.6.
6.11.64	KAILIS, M.G.	Perth	U/S Crayfish	27. 0.0.
6.11.64	POZZI, Guido John	"	"	50.15.0.
20.11.64	BRIGHT SPOT CATERERS	"	Illegal possession of craymeat	6. 0.0.
15.10.64	BORRIE, Douglas L.	Geraldton	U/S Crayfish	10. 0.0.
21.10.64	LOPRIORE, Nunzio	"	Obstruction and U/S Crayfish	50.17.0.
<u>FAUNA PROTECTION ACT</u>				
29.8.64	POBOR, Peter Michael	Fitzroy Crossing Childrens Court	Taking protected fauna	1. 0.0.
29.8.64	LENNARD, Norman M.	Fitzroy Crossing Police Court	Taking protected fauna	1. 0.0.
29.8.64	HIGGINS, Paul	"	"	1. 0.0.
29.8.64	FABIAN, Sydney, G.	"	"	25. 0.0.
26.10.64	VIS, Frank	Kununurra	"	20. 0.0.
26.10.64	ARLT, Manfred	"	"	20. 0.0.
26.10.64	ARLT, Ercharadt	"	"	20. 0.0.
2.11.64	FABIAN, Sydney, G.	Derby	Illegal possession of Johnstone crocodile skin	5. 0.0.
2.11.64	FABIAN, Sydney, G.	"	Possession of salt water crocodile skins for sale without license	Cautioned

Convictions Continued

Date	Defendant	Court	Charge	Result
6.11.64	DEP, Chin Loong	Derby	Possession of fauna suspected of being illegally taken	10. 0.0.
6.11.64	DEP, Brian	"	"	10. 0.0.
18.11.64	MORTON, Frank	Perth	"	5. 0.0.
18.11.64	TEMPLETON, Ronald	"	"	5. 0.0.
2.12.64	LEE, Brian	"	Obstruction	2. 0.0.
2.12.64	LEE, Brian	"	Taking protected fauna	5. 0.0.
2.12.64	BUTLER, Leslie	"	"	5. 0.0.

ADDITIONS TO PERTH DISTRICT OFFICE

To ease the staff accommodation problem tenders are currently being called for additions to the Perth District Office buildings at Victoria Park. The additions will provide accommodation for Wildlife Research Officer T.L. Riggert and the fauna wardens, as well as a new laboratory. A re-arrangement of Head Office accommodation has been approved and will be made as soon as possible.

CRAYFISH INDUSTRY - ECONOMIC SURVEY

Numerous enquiries, from departmental officers and other interested persons, have been received as to when the report on the economic survey undertaken in October, 1963, will be published. It is evident, from the great interest shown, that many people are anxious to see what the studies have disclosed.

This Department, following enquiries made in Canberra, has been notified that by reason of changes in the presentation of the analysis of the information gathered and the transfer of the economists concerned from the Department of Primary Industry to other Departments, extreme difficulty is being experienced in finalising the report. It is hoped, however, that publication will be effected without much more delay.

If any officer is approached by any person asking when the report will be released, they should be advised in terms of the foregoing.

MONOFILAMENT NETS

Much discussion has taken place at recent Commonwealth-States Fisheries Conferences concerning the use of monofilament nets in the Australian fishing industry.

The matter was first raised at the instance of the New South Wales Department. This followed action to ban the use of monofilament nets in the salmon fishing areas of the west coast of Canada in 1962.

Canadian experience with these nets was described in a letter from the Deputy Minister for Fisheries in Ottawa to the Fisheries Branch of the Department of Primary Industry, Canberra. So that officers may appreciate the Canadian situation, which does not appear to be on all fours with that in any part of Australia, we are setting down the main points set out by the Deputy Minister.

- \* In 1961, 57 west coast salmon fishermen were using either monofilament gill nets or normal linen or nylon nets with panels ("cuts") of monofilament netting some 50 fms. in length near the centre. Forty had Japanese netting and the remainder German.
- \* Studies by departmental officers revealed that the monofilament nets were more efficient in muddy water - at least, there was some evidence to substantiate this finding. In murky waters the catches of fishermen with monofilament nets were up to four times the average catches of those using ordinary gear. Even fishermen using only panels of monofilament netting found their catches significantly increased.
- \* In the salmon fishery it is necessary to provide for an adequate escapement of fish for spawning, and consequently much of the Canadian west coast is under tight control. In some areas salmon fishermen with ordinary gear are allowed to operate as little as 24 hours a week to ensure sufficient escapement. Elsewhere spawning requirements are met by week-end closures.
- \* It quickly became obvious to the Canadian Department that if the new monofilament gear proved more efficient than conventional linen or nylon, new regulations would need to be made to offset the increased catch efficiency.

- \* In considering the matter, the Department did not have to concern itself with the possibility of the gear killing small fish as well as large, since all the fish caught during the salmon runs were fully mature. What had to be faced was the fact that the salmon population was limited and that increased catches resulting from more efficient gear would accordingly need to be countered by further reducing fishing time.
- \* If all fishermen were forced by pressured competition to adopt monofilament gear, so the departmental experts argued, they would take the same number of fish, but in a shorter time and at higher cost. Notice had to be taken, too, of the effect shorter fishing time would have on the availability of work at the shore plants and on auxiliary industries supplying the canneries.
- \* After very careful consideration it was decided in 1962 to ban monofilament gear in the salmon fishery. The real reason, as may be seen, was economic, but on conservational grounds as well, the fishery needed this tight control.

The Superintendent of the N.S.W. Department, when bringing the matter before Conference, drew attention to the Canadian monofilament story and also to overseas suggestions that due to the springiness of monofilament nets, fish are not entangled as readily as in conventional multifilament netting, thus necessitating more constant supervision by fishermen. He said that in his State concern was felt that as monofilament is non-perishable, it could be most destructive to fish in the case of a net being lost and continuing to fish until recovered or finally destroyed by action of the sea.

Upon consideration, Conference expressed the opinion that in some situations the use of monofilament nets in Australian fisheries could be undesirable, by reason of their high efficiency, and could adversely affect those fisheries which now appear to be in a stable condition. It considered that tests should be carried out to determine the efficiency of monofilament in comparison with ordinary nets, and to assess the possible consequences of the introduction of this gear. A working party was appointed to design a standard set of tests, and a recommendation made to a subsequent meeting of Fisheries Ministers that pending the

pending the completion of these tests, the Commonwealth Government be moved to prohibit importation under the Customs laws. (Conference was subsequently advised that the Customs Department did not agree to prohibit importation).

In New South Wales, a regulation was gazetted in March, 1964, prohibiting the use in, or the possession on or adjacent to, any tidal or inland waters any net constructed wholly, or in part, of any monofilament synthetic material.

On the other hand, the majority of the States, certainly Victoria and Western Australia, do not possess the power under existing legislation to ban monofilament nets as such. The use of nets may, of course, be regulated or prohibited, but any regulation or prohibition applies equally to multifilament as to monofilament nets, regardless of the material from which they are constructed.

However, in Victoria, the Department of Fisheries and Wildlife has been successful in securing the co-operation of fishermen in maintaining fishing logs of operations in which monofilament gear is used. The purpose is to attempt comparisons in efficiency. Furthermore, the fishermen have agreed to hang monofilament netting with natural fibre material, so that nets lost during fishing operations will eventually collapse and sink, thus obviating the possibility of "ghost fishing" for any lengthy period thereafter.

We in Western Australia have had little experience so far with monofilament gear. Some Bunbury fishermen recently purchased 7" monofilament netting for constructing shark nets, but their experience has been unfortunate. Great holes appeared along the lead lines, the knots slipped badly, and although quite strong when just "straight" pulled, the filament broke very readily if it only slightly abraded. The fishermen concerned regard their experient as a "dead loss".

The Department believes that other fishermen, perhaps estuary fishermen, might desire to use monofilament. If such be the case, and district inspectors learn of the move, they might report the matter to the Department so that we too may endeavour to induce them to keep logs, such as is being done in Victoria. They might also suggest to fishermen, particularly those fishing in offshore waters, that natural fibre material be used for hanging the nets so that if lost they will not continue to fish for too great a period.

## CLEARING HOUSE

### PROBLEM OF DECAY IN WOODEN VESSELS

The increased incidence of decay recently found in wooden fishing vessels has aroused great concern. Torry Research Station together with the Forest Products Research Laboratory worked on this problem particularly in relation to fish rooms and reported on counter measures in Torry Advisory Note No. 7. Mr. A. Sutherland, senior technical officer for the White Fish Authority Scottish Committee has also worked on the problem of decay, and the following account summarises his recent report on the subject.

Decay is most commonly found in timbers comprising the fish room including Oregon pine decking, larch beams and stringers and to a lesser degree in oak frames, clamps, beams and knees. The spores of the fungus responsible for decay are present in the atmosphere and they will germinate and the fungus spread if the following conditions are present together:

- \* A moisture content, in timbers which have not been effectively sterilised and properly treated with wood preservative, of over 20 per cent.
- \* Available oxygen.
- \* Favourable temperature between 32 deg. F and 90 deg. F.
- \* Suitable food material.

Where any one of the conditions is absent, decay will not occur. It is obvious that certain locations on a vessel will be less favourable than others, for instance oxygen has no access to the keel and decay here would be exceptional. In the fish room conditions for decay are nearer optimum than elsewhere and although increased ventilation would materially assist in keeping the moisture level in timbers below the danger level, it would also tend to raise the temperature and dry the fish.

#### More Care Needed

It is clear that more care is required in the selection of timber to be used in vessel construction, only durable timber should be used, particularly in the fish room.

Decay can be avoided, providing all timbers are sterilised and properly treated with a suitable wood preservative. Ideally the timbers should be either very resistant

to decay and/or be pressure impregnated with wood preservative.

Unfortunately, all the timbers used in vessel construction cannot be pressure impregnated, the nature of the process does not lend itself to the treatment of large curved timbers such as frames and these should, if possible, be dipped in an open tank containing wood preservative or brushed with this, care being taken to brush any timber which has been cut during the assembly of the hull.

Decking timbers do lend themselves to pressure impregnation and should be so treated. When laying the impregnated timber on the deck it is necessary to cut the ends to suit fitting and to drill holes for the fasteners to be spiked onto the beams.

All such ends must be liberally brushed or dipped in wood preservative. After hammering in the deck fasteners, wood preservative must be poured into holes before the treated dowels are fitted.

Wood preservative should be either of Copper Naphthenate or Penta Chlorophenol composition. Creosote, although an excellent wood preservative, has a penetrating odour which could taint the fish.

Fish room timbers particularly have a high moisture content which can be measured with an electrical resistance type moisture meter.

### First Step

First step in preventing decay is to dry these timbers to a content of approximately 30 per cent. It would be desirable to dry to a content below this level but this should be avoided as there will be a tendency for the timber to split especially if drying is carried out quickly.

Several dehumidifying machines are available on the market and, depending on the moisture in the wood, drying to a 30 per cent level will be effected with continuous running within 48 hours. It is considered that this method is safe and efficient.

After drying to the required level, wood preservative should be liberally applied, special care being taken to ensure that pockets behind the beam stringers and the hidden faces of stringers are also treated.

Painting or the application of a similar seal should be avoided in the fish room as water vapour which enters cracks in the paintwork is difficult to extract. At the same time it may prove necessary to re-treat the timbers and if these are painted it will be impossible to brush or spray with wood preservative. In similar manner the painting of newly delivered timber should be discouraged as this seals in moisture and prevents natural dehydration.

If this is not extensive the affected timber should be cut back and the sound timber can then be liberally treated with wood preservative.

Where decay is extensive whole members should be replaced with new timber which has been well coated with preservative. All timber which has been removed should be burned.

(Fishing News

London

November 6, 1964)

#### FAO PRESSES ON TOWARDS GREAT FISHERY SERVICE

Progress is being made in study of the lines on which the Fisheries Division of FAO may be adjusted in order to render greater service to the world's fishing activities (Fishing News October 9).

At its meeting early in October, the council of FAO set up an ad-hoc committee to study FAO's role in world fisheries development, and how this might best be re-organised and expanded.

This action follows a resolution passed during FAO's biennial conference last year, in which Dr. Sen was asked to consider re-organisation and expansion of the work in fisheries. Subsequent to that, a comprehensive letter was sent by Dr. Sen to interested countries inviting provisional views.

The members of the ad-hoc committee which has been instructed to report to the Council's next session in June 1965, will consist initially of representatives from Chile, France, Iran, Italy, Philippines, Senegal, the United Kingdom and the United States.

Membership, however, will also be open to other members who are now, or will be in January, members of the council and who wish to participate in its work.

(Fishing News

London

November 6, 1964)

ONE MAN LANDS CATCH ON NEW STERN TRAWLER

An unusually interesting 64ft. stern trawler has been built by the Blount Marine Corporation at Warren, Rhode Island, U.S.A. for the Narragansett Trawling Corporation of Point Judith, R.I.

Named Canyon Prince, she is designed to meet the needs of fishing fleets such as those operating out of Point Judith, R.I., where the size of vessels is predominantly in the 65ft. length range. She has been especially fitted out to trawl in submarine canyons at the edge of the Continental Shelf. Being a western rig, it can be used for all types of fishing, and has a maximum capacity of 100,000 pounds of ice and fish for short haul operations.

Effortless

Net-handling on this newest American Stern trawler is so simple and effortless that a catch of several tons can be boated by a single deckhand in a few minutes.

All winches and hoists are controlled from the pilot-house, which overlooks the deck. The vessel is equipped with all the latest electronic fish-finding and navigating instruments. A 340 h.p. GM12V71-N diesel engine powers a 60-inch fixed pitch propeller which drives the boat at a speed of  $11\frac{1}{2}$  knots.

At the time Narragansett was designed, U.S. experts, thinking in European terms, advised the Blount Corporation that a stern trawler under 120 feet in length was not practicable. The success of Narragansett, the first small stern trawler to be built by Blount, exploded this theory.

Narragansett's midship netdrum was the innovation which made a small stern trawler practical, and its simple design brought it within the reach of the average fishermen. The Narragansett claims a world record for the shortest net hauling time with two men on deck.

The new Canyon Prince has surpassed this record on her fishing trials off Block Island, R.I. with the 17-year-old daughter of the builder taking over for the occasion as sole deckhand.

### CHILE PLANS TUNA EXPORT INDUSTRY

To develop an export tuna industry, Chile is building a modern fish canning and freezing plant at Iquique. The Government-owned plant is expected to process between 25,000 and 30,000 metric tons of tuna, bonito, and sardines annually (mostly for export). The anticipated opening of the new plant has been delayed; it will probably not be in operation before the first quarter of 1965. The new plant, with its 3 automatic canning lines, will be capable of an annual production of 400,000 cases of tuna (48 1/2-pound tins) and 360,000 cases of Spanish sardines (48 1-pound tins). The cold-storage capacity of the new plant will be 100,000 tons of fish; freezing facilities will consist of a blast-freezing room and a brine-freezing installation. The new enterprise also includes a fish meal plant which began operating in June 1964.

The supporting fleet for the new plant will be composed of 8 tuna vessels and 9 anchoveta vessels. The anchoveta fleet is already working. The first vessel of the tuna fleet, the 170-ton "Santa Rosa", started fishing in December 1962. (The company has used the cold-storage facilities of another plant to process frozen tuna and bonito from the "Santa Rosa" for export). Two 310-ton vessels, acquired from Great Britain are expected to join the "Santa Rosa" in late 1964. Five 110-ton purse seiners were ordered from German shipyards for the tuna fleet. Those vessels are scheduled for completion and delivery in late 1964.

(Market News Service                      New York                      November 23, 1964)

### SHRIMP FARMING

The idea of shrimp farming, or cultivation of shrimp under controlled conditions in salt- or brackish-water ponds, has aroused much interest in the United States in recent years. Shrimp appear particularly desirable for artificial cultivation because of their rapid growth and high market value. In addition to their worth as human food, shrimp are in great demand seasonally as live bait for sport fishing.

Methods used in shrimp farming take advantage of the ability of certain shrimp to survive and grow rapidly in shallow estuarine waters. By constructing ponds, the shrimp farmer alters the natural environment so that the poundage of shrimp normally harvested from the estuarine areas is greatly increased. It is anticipated that by proper timing, a shrimp farmer may control the development of his stocks, so that abundant live-bait shrimp of appropriate size can be harvested at the peak of demand.

The culture of shrimp and other marine animals is an important industry in certain maritime countries of Southeast Asia. Shrimp farming in the United States is still in its infancy, however, and extensive research is required to determine its biological and economic feasibility.

(Commercial Fisheries Review Washington October, 1964)

### MAMMALS CAN BREATHE WATER

Mice and dogs, under certain conditions, can be submerged in water for considerable periods of time without drowning. Under these circumstances the animals actually breathe the way a fish does; their lungs, acting as gills, extract oxygen from the water.

Submerged adult mammals usually drown because water in contact with air does not contain enough dissolved oxygen. But if the oxygen pressure above the water is raised, more oxygen dissolves. The rate of increase is such that under eight atmospheres of pressure the amount of oxygen dissolved in water is roughly equal to the amount of oxygen in air. Under these circumstances water now "resembles" air a bit more closely and experiments have shown that, with some salts added, mice and dogs can breathe water and survive.

### Gills to Lungs - and Back

This observation should not be too surprising on close inspection. The fetuses of mammals, including the human fetus, live submerged in a fluid that is not too dissimilar to sea water in many ways. Newborn mammals survive submersion for considerable periods of time. Signs of life have been observed in puppies up to 54 minutes after submersion in water. Newborn rats have made respiratory movements for more than 40 minutes after submersion. This tolerance for submersion, however, diminishes rapidly with age. The submerged newborn mammal's survival time is extended not because the lungs can extract enough oxygen from the water but only because the animals have a remarkable tolerance to lack of oxygen. This is very fortunate because the oxygen supply to the fetus may be jeopardized during and shortly after birth.

Mammals have evolved from fishes, and during the development of the mammalian fetus past evolutionary stages are re-traced. Evolution is generally considered to be

irreversible, but the ancestors of contemporary aquatic mammals such as whales, seals and porpoises lived on land. It is true that these water animals breathe air and thus are surface bound but neither evolution nor the tendency toward reversed evolution have necessarily been completed yet. At any rate, the apparent gap between mammalian and fish-like breathing has now been bridged, at least experimentally, for a short time and under special circumstances.

#### Mice Breathe One Mile Down

Adult "Swiss" mice of both sexes were used. A small chamber was partly filled with water to which various salts had been added in similar amounts as those present in blood. Air in the chamber was replaced by compressed oxygen. The fluid was agitated to hasten solution of the gas. After approximately thirty minutes, a mouse was introduced into the chamber via a lock. The mouse was prevented from surfacing by a grid.

This basic procedure was followed with a number of mice at an oxygen pressure of eight atmospheres. The mice continued to breathe for several minutes and, in some cases, hours. The longest survival times occurred when the temperature of the solution was 68°F. The mice were initially active and alert while submerged and did not appear to be in severe distress. The procedure was repeated in another chamber which could be pressurized up to 160 atmospheres, equivalent to the pressure of sea water at a depth of one mile. Even this extraordinary pressure did not kill the mice.

Mice submerged in the oxygenated solution usually appeared to lose consciousness within one-half hour but when a chemical "buffer" (a substance which tends to hold the acidity of a solution constant) was added, the animals responded to stimuli such as shaking the tank or knocking on the walls for up to six hours.

Mice that have breathed fluid for ten to thirty minutes have subsequently been kept alive for over two hours in the unflooded portion of the chamber. Unfortunately, the transition from fluid breathing to air breathing has not been successful in mice.

#### A Larger Subject Needed

A small animal, such as a mouse, locked in a miniature pressure vessel is a difficult object for detailed physiological study. For this reason, additional experiments

were conducted with dogs in a pressure chamber large enough to accommodate the air-breathing investigator together with the fluid-breathing anesthetized dog.

The larger chamber is essentially like the smaller one except that both experimenter and dog are subjected to the same pressure, the dog, however, being submerged in the oxygenated fluid. The fluid is contained in a large tub.

The animal is anesthetized, shaved, washed and given penicillin and streptomycin. The dog is then fastened to a board that is suspended from the ceiling of the compression chamber just over the bath. An airtight cover is placed over the dog and attached to the outside of the tub. The chamber is pressurized to five atmospheres and oxygen is bubbled through the bath for ten minutes. The airtight cover over the bath protects the attendant from oxygen poisoning by preventing oxygen from freely escaping from the bath to the rest of the chamber. The dog is submerged in the bath and bubbling of oxygen is discontinued. The surface of the water in the bath, however, is still in contact with the oxygen at five atmospheres pressure.

### Dogs Survive

Under these conditions, six dogs lived submerged while breathing an oxygenated saline solution for from twenty-three to thirty-eight minutes. The duration of the fluid breathing was limited by the long decompression time needed by the attendants rather than by ill effects to the animals. One of the dogs which breathed water for twenty-three minutes has been adopted as a mascot by submarine rescue vessel H.M. Cerberus of the Royal Netherlands Navy. In another series of experiments a dog which survived twenty-seven minutes of fluid breathing has recently given birth to nine healthy puppies.

Many animals did not fare so well, however, on being returned to the surface. Ironically, it appears that the return from water to air breathing is much more hazardous than the initial submersion or prolonged fluid breathing in itself.

When an animal is brought to the surface, its lungs are drained mechanically but some of the fluid remains in the alveoli or tiny sacs at the ends of the branches of the bronchial tubes. Until the fluid is absorbed, a process which takes hours, gas exchange in the lungs is seriously impaired. The reverse occurs when the animal is first immersed. Then, gas exchange is initially impaired until the nitrogen in the alveoli, left over from the animals

recent air breathing, has been absorbed and replaced by the oxygenated fluid. The absorption of nitrogen, however, is much faster than that of the liquid and so the period of impaired gas exchange in the lung is fairly brief upon submersion.

It may be that readaptation of terrestrial animals to a gaseous environment after prolonged liquid breathing will require some means of aiding the normal process of gas exchange until the residual fluid in the lungs has been absorbed and the alveoli are normally expanded again with air.

### Next Step Man?

Man has tried for centuries to invade the oceans by carrying a supply of air with him but the gas in his lungs, compressed by the layer of water above, soon becomes dangerous to breathe. The nitrogen in air, for instance, affects the brain like an anesthetic at depths greater than 100 feet, producing a state resembling intoxication known by divers as the "rapture of the deep". The properties of water, on the other hand, hardly change at all under pressure and this explains, in part, why some fish can live at the bottom of the Phillipine Trench, six miles deep, apparently unaffected by pressures as high as 15,500 pounds per square inch.

When a man dives to a great depth, large amounts of the gas in his lungs dissolve in his blood and tissues because of the high pressure. Oxygen is used up by the cells but other gases such as nitrogen are stored in the body and may be released as bubbles when the diver returns to the surface too rapidly, much like the effervescence in a bottle of carbonated water caused by the sudden release of pressure when the cap is removed. Bubbles in blood and tissues have caused serious disability or death in many a diver.

### Truth, Not Fantasy

The air we breathe is a mixture of oxygen and nitrogen. Oxygen is taken up by the lungs and carbon dioxide is given off in exchange while nitrogen merely serves as a carrier of these gases. In fish, oxygen and carbon dioxide are dissolved in water that enters and leaves the gills. The only basic difference between air breathing and liquid breathing thus concerns the properties of the carrier medium. If man were able to breathe oxygenated water instead of oxygenated nitrogen he would not be hampered by gas toxicity and decompressions sickness in his attempts to penetrate the depths of the ocean.

Of course, the step from limited breathing by mice and dogs of a carefully controlled and buffered saline solution in the laboratory to human beings blithely breathing like fish in the sea is a long and difficult one, if it is ever to be taken at all.

Much is still speculation, but hardly fantasy. The basic idea has been proven correct. Mammals can breathe like fish. It remains to be seen how far this ability can be extended.

(Sea Frontiers

Miami

September, 1964)

#### LIQUID SMOKE

English investigators have perfected an economically feasible method for producing liquid smoke with which to cure fish. The advantages are that dipping in liquid smoke saves time and space and there is no loss in quality of the product.

Normally, when fish are hung in a smoke-house, the smoke passes into solution in the moisture on the surface of the fish. The solution becomes concentrated and penetrates the tissue.

In the present method, a water-smoke solution is prepared before-hand, under exactly controlled conditions which produce the correct concentrate. The fish is then soaked for twenty minutes and dried for two and one-half hours.

(Sea Frontiers

Miami

September, 1964)

#### WHAT IS SEA LEVEL?

The oceans which wash the beaches of the United States have risen from two to nine inches since 1940. Some of the rise is caused by melting of polar ice caps but some is only an apparent rise caused by a sinking of the land. In some cases the land is rising faster than the ocean bordering it and there is thus an apparent falling of sea level. This is the case in southeast Alaska. So far, say Coast and Geodetic Survey oceanographers, there is no evidence that the trend will reverse itself.

(Sea Frontiers

Miami

September 1964)