TMENT, WESTERN AUSTRALIA

SERVICE BULLETIN

Vol.XII, No. 6 June, 1963

STAFF NOTES

The Director, Mr. A.J. Fraser, left Perth on May 24 for Sydney and Canberra to discuss Commonwealth-State co-operation in extra-territorial waters. On June 10, Mr. Fraser will leave by road for Shark Bay and Carnarvon where he will review the progress of the prawn fishing industry and inspect the processing establishments at Carnarvon and at Denham in Shark Bay. He will spend a day in Geraldton and return to Perth about June 18.

* * *

The Senior Research Officer, Mr. B.K. Bowen, returned from Geraldton on May 19. He reported that he was very satisfied with the progress made in the survey of the crayfish habitat at the Abrolhos, and with the crayfish sampling programme at the various Geraldton processing works.

* * *

Mrs M.A. Stone commenced duty on May 14 to take the place temporarily of Miss M.A. Bartlett, who resigned last month. Mrs Stone ceased duty on May 31. She is being replaced by Miss S. Paton.

* * *

The Supervising Inspector, Mr. J.E. Bramley, visited the Bunbury district from May 9 to 12. He left on May 20 for a seven-day trip to Geraldton and the Abrolhos.

* * *

Research Officer R.J. Slack-Smith left Perth on May 17 for Shark Bay and Carnarvon to continue his prawn research programme. He will return to Perth about June 15.

Captain F. Galbraith, Master of the r.v. "Peron", has submitted his resignation from the service from close of business on June 25. It is hoped that a new appointment will be made in time for the vessel to leave for Shark Bay early in July to undertake deep-water fishing tests. The "Peron's" refit has been almost completed.

* * *

Technical Officer J.S. Simpson will go to Pemberton on June 20 to arrange the transport to Perth of 100,000 live trout eggs for shipment by air to the hatcheries at Ballaarat, Victoria.

* * *

Fauna Officer H.B. Shugg will accompany Dr. A.R. Main to Pingelly on June 13 to meet representatives of the Public Works Department for on-the-spot discussions on the siting of the proposed quarters and laboratory on Reserve 25555. Dr. Main, who is a reader in Zoology at the University of W.A. is a deputy member of the Fauna Protection Advisory Committee.

* * *

Senior Inspector J.E. Munro visited the prawning grounds and processing works at Carnarvon and Denham from May 10 to 17. A summary of his report appears elsewhere in this issue. Mr. Munro will commence three weeks' leave on June 4.

* * *

Officers who last month resumed duty after annual leave included Messrs G. Ferguson and P. Yewers and Miss H.M. Sivwright (all of Head Office). Cadet Inspector Ian Cardon and Inspector E.H. Barker, of Bunbury, also resumed duty after leave. Inspector Barker has been recommended for promotion to Technical Officer, Grade 2, the item vacated by Mr. R.J. McKay on his promotion to the Senior Technical Officer's item.

Officers who will start annual leave this month include Technical Officer R.J. McKay on June 4, Assistant Inspector L.R. Frizzell on June 4, and Inspector A.V. Green of Geraldton, who is at present on annual leave, will resume duty on June 11.

* * *

Cadet Inspector P.C. Willey will commence annual leave on July 1.

* * *

The r.v. "Lancelin", under the command of Captain C.J. Seabrook, with Mate C.R.C. Haynes, and Cadet Inspector P.A. Smith as deck hand, will sail in the first week of July for Onslow. Technical Officer J.S. Simpson will also be on board while Senior Research Officer B.K. Bowen and Technical Officer R.J. McKay will join the vessel at Onslow about July 23 to carry out fishing tests and underwater observations on the various species of coral crayfish. They will use 30 steel-framed, wire and cane-covered pots and a "tangle" net to try to assess the catchability of the northern crayfish.

FISHERIES TRAINING SCHOOL

The 1963 Australian Fisheries School for field officers will be held at the C.S.I.R.O. Marine Laboratory, Cronulla from September 9 to 27. The Minister for Fisheries Mr. Ross Hutchinson, has again approved three officers attending from this Department. Those selected are - Pearling Superintendent R.J. Baird, Technical Officer E.H. Barker and Inspector D.P. Gordon.

BERNIER ISLAND SURVEY

With her return to Geraldton on May 28 the p.v. "Vlaming", under command of her

skipper Inspector F.J. Campbell with crew member Assistant Inspector A.H. Ullrich and Fauna Warden N.E. McLaughlan acting as pilot, successfully completed the Shark Bay-Bernier Island-Carnarvon run outlined in the previous issue of this Bulletin. In his report on the trip, Mr. McLaughlan said that the "Vlaming" sailed from Geraldton on May 11 for Shark Bay which she reached the following day after familiarisation runs through South Passage and in the inner bar area. A survey of the anchorage at Herald Bight was also made. On May 16, after taking on board the scientific party and their stores, she sailed from Carnarvon to Bernier and unloaded the party and their gear at Hospital Anchorage. An inspection on the following day revealed that three boats were operating on the snapper grounds north of Koks Island. They were the "Rex" and the "Lapwing", which were both using handlines, and the "Canberra" which was using traps. None of the vessels were enjoying good catches. The fishermen said that the snapper had not commenced to school. "Vlaming" anchored at Cliff Rock that night in strengthening winds. The following day, May 18, she ran down to Quoin Bluff on Dorre Island to collect specimens for the scientific party and then returned to Bernier Island where Messrs McLaughlan and Ullrich went ashore to search for a particular species of spinifex - Triodia plurinervata. They found one extensive patch of this plant - it was half-a-mile long and 500 yards wide - about one mile south of Red Bluff. Twenty-six goats were also observed along the cliffs on the west coast opposite Red Bluff, and five were shot for food. Further assistance to the shore party was not possible for some days as strong south-east to north-east winds were experienced from Sunday evening, May 19, to Wednesday, May 22. A small fishing party of three men in an open 15-ft. launch with an outboard were stranded at Bernier Island and were taken aboard "Vlaming" during the cyclone.

Mr. McLaughlan said that this was a most uncomfortable period. The combination of cyclonic winds, high seas and rain, and the lack of a safe anchorage endangered

the vessel and drenched the crew. Anchor watches had to be maintained each night, and shifts in the wind made it necessary to move the vessel from one anchorage to another, and back again, and to safer sections of each anchorage in turn. On the night of May 21, the fishing vessels "Rex" and "Canberra", which with the "Lapwing" had been anchored alongside "Vlaming", moved out to sea to ride out the gale. The conditions rendered sleep and cooking almost impossible and all bedding and clothing were drenched. The shore party fared little better, being unable to cook on their exposed campfire, and most of their equipment and clothing was also soaked through. Although the adverse weather conditions restricted activities the party were very happy with the overall results of the trip, in which the main objects were achieved. Indeed, some surprising results have been reported by Dr. Ride who has promised a full report of the scientific findings.

"Vlaming" returned the party to Carnarvon on the morning of May 23, and, after refuelling, sailed in the early afternoon for Cape Peron, anchoring for the night at Herald Bight. The following day, bad weather forced her to seek shelter in South Passage, and she finally got to Denham on May 25. She sailed from that port for Geraldton the following day. Mr. McLaughlan returned to Perth by road bus on May 28.

It has been decided to send the "Vlaming" back to Shark Bay for six to eight weeks to carry out night patrols in the southern prawn grounds which are closed to trawling.

PUBLIC SERVICE RECLASSIFICATION

A special Gazette published on May 29 includes a complete review (undertaken by the Public Service Commissioner) of all positions in all Departments of the Public Service. For the information of staff an extract of this department's establishment (emended to include wages personnel) has been reproduced and appears on pages 140 to 142. As previously, the Department is divided into five branches and only the classifications of those positions marked with an asterisk have been increased.

Item No.	Branch or Section and Title of Office	Name of Officer	Classification on 1st January, 1963.		Allowances on 1st January, 1963.	
			Division Group and Class	Gross Annual Salary Rate (Excluding Allowances)	Annual Rate	Nature.
	Administrative			£		
1931 *	Director and Chief Inspector	Fraser, A.J.	A-I-5	3,240	-	-
1932	Pearling Superintendent (Broome)	Baird, R.J.	G-II-3	1,580	15	-
1933	Fleet Maintenance Officer	Bateman, A.J.	G-II-2	1,460	-	-
1934	Library Assistant	Sivwright, H.M.	C-V	665	-	-
	Clerical					
1935 *	Administrative Officer	Saville, B.R.	C-II-8	2,180	-	-
1936	Clerk	Byleveld, J.B.	C-II-1	1,360	-	-
1937	Clerk	Casselton, C.W.E.	C-IV	1,260	-	-
1938	Clerk	Ferguson, G.C.	C-IV	1,088	-	-
1939	Typist	Vacant	C-V	-	-	-
1940	Typist	Hall, R.A.	C-V	597	-	-
Temporary	Assistant	Gilfellon, H.M.	G-IX	597	-	-
	Fauna Protection					
1941	Fauna Officer	Shugg, H.B.S.	C-II-4	1,700	-	-
1942	Clerk	Yewers, P.G.	C-IV	940	-	-
1943	Warden	Bowler, S.W.	G-II-1/2	1,460	-	-
1944 *	Warden	McLaughlan, N.E.	G-II-1/2	1,410	-	-
	Research					
1945 *	Senior Research Officer	Bowen, B.K.	P-II-9/11	2,300	-	
1946 *	Research Officer	Slack-Smith, R.J.	P-II-2/8	1,520	720	Temporary

Item No.	Branch or Section and Title of Office	Name of Officer	Classification on 1st January, 1963.		Allowances on 1st January, 1963.	
			Division Group and Class	Gross Annual Salary Rate	Annual Rate	Nature
1947	Master, Research Vessel	(Vacant)	G-II-6	-	-	
1948	Master, Research Vessel	Seabrook, C.J.	G-II-4	1,700	-	
1949	Engineer, Research Vessel	Mackenzie, E.A.	G-II-3	1,520	-	
1950	Technical Officer, Grade 1	McKay, R.J.	G-11-3	1,520	-	
1951	Technical Officer, Grade 2	Vacant	G-II-1/2	-	-	
1952	Technical Officer, Grade 2	Simpson, J.S.	G-II-1/2	1,460	-	
1953	Mate, Research Vessel	Wright, D.	G-II-2	1,460	-	
1954	Mate, Research Vessel	Haynes, C.R.C.	G-II-1	1,360	48	Special
Wages	General Hand, Res. "	O'Sullivan, J.P.	Special Award			
	Inspection					
1955	Supervising Inspector	Bramley, J.E.	G-II-5	1,820	-	-
1956	Senior Inspector	Munro, J.E.	G-II-3	1,580	-	-
1957	Senior Inspector	Melsom, A.K.	G-II-3	1,580	12	Special
1958	Inspector, Grade I	Traynor, J.	G-II-2	1,460	-	-
1959	Inspector, Grade I	Green, A.V.	G-II-2	1,460	15	(a)
1960	Inspector, Grade I	Crawford, R.M.	G-II-2	1,460	15	(a)
1961	Inspector, Grade I	Carmichael, B.A.	G-II-I	1,410	15	(a)
1962	Inspector, Grade I	Jeffery, G.C.	G-II-2	1,460	-	-
1963	Inspector, Grade 2	Gordon, D.P.	G-II-1	1,310	-	-
1964	Inspector, Grade 2	Barker, E.H.	G-II-1	1,310	-	-
1965	Inspector, Grade 2	Baines, T.B.	G-II-1	1,360	15	(a)
1966	Inspector, Grade 2	Forster, E.I.	G-II-1	1,360	50	Responsibility

Item No.	Branch or Section and Title of Office	Name of Officer	Classification on 1st January, 1963.		Allowances on 1st January, 1963.	
			Division Group and Class	Gross Annual Salary Rate (Excluding Allowances)	Annual Rate	Nature
				£		
1967	Inspector, Grade 2	Campbell, F.J.	G-II-1	1,360	50	Respons-ibility
1968	Inspector, Grade 2	Pearce, A.T.	G-II-1	1,360	50	"
1969	Assistant Inspector	Hanley G.	G-VII-1/2	1,008	-	-
1970	Assistant Inspector	Ostle, C.W.	G-VII-1/2	1,008	-	-
1971	Assistant Inspector	Ullrich, A.H.	G-VII-1/2	1,008	-	-
1972	Assistant Inspector	Frizzell, L.R.	G-VII-1/2	1,008	-	-
1973	Assistant Inspector	Smith, D.H.	G-VII-1/2	1,008	-	-
1974	Assistant Inspector	Emery, R.G.	G-VII-1/2	1,008	-	-
1975	Assistant Inspector	Kelly, J.T.	G-VII-1/2	940	-	-
1976	Cadet Inspector	Cardon, I.L.	G-VII-1	940	-	-
1977	Cadet Inspector	Willey, P.C.	G-VII-1	842	-	-
Wages	Cadet Inspector	Enright, P.K.	G-VII-1	842	-	-
Wages	Cadet Inspector	Smith, P.A.	G-VII-1	940	-	-
Wages	Cadet Inspector	Morrison, K.	G-VII-1	599	-	-

(a) Duties under Marine Act.

The salary rates shown in the table include all basic wage rises to May 29 as well as the new salary margins which applied from January 1. The figure shown against each officer therefore is his or her current gross salary.

The only officers to receive increases in classification were;

- Director, Mr. A.J. Fraser from A-I-4 to A-I-5,
- Chief Clerk, Mr. B.R. Saville (retitled Administrative Officer) from C-II-7 to C-II-8,
- Warden, N.E. McLaughlan from G-II-1 to G-II-1/2,
- Senior Research Officer, B.K. Bowen, from P-II-8/9 to P-II-9/11,
- Research Officer, R.J. Slack-Smith from P-II-3/7 to P-II-2/8,
- Inspector, B.A. Carmichael from G-II-1 to G-II-2,

Officers who are dissatisfied with either the classification of their position or its title may lodge an appeal with the Public Service Appeal Board. Forms of appeal may be obtained from the Civil Service Association, and must be lodged with the Secretary of the Public Service Appeal Board, S.G.I.O. Building, St. George's Terrace, by June 29. If the appellant intends to request the Civil Service Association to provide an advocate, the notice of appeal should be made out in quadruplicate. Two copies will be sent to the Secretary of the Appeal Board, one will be retained by the appellant and the fourth will be sent to the Association. The Public Service Board Appeal Act provides that an appellant may conduct his own appeal or have counsel appear for him. The choice of counsel is unrestricted and may be an Association advocate, a private solicitor or any other person.

PRAWNING.

The progress and development of a prawning industry in this State is most encouraging. It seems likely that the value of the annual processed catch of Shark Bay prawns will reach the £1,000,000 mark before many years are out. The determination of private firms to carry on exploratory fishing in other areas to supplement the earlier work carried out by the Department, reflects the confidence of the industry in the State's prawn potential.

The decision of the Government to accept departmental advice and restrict the number of trawling licenses has generally been very well received. There has been, of course, some dissatisfaction amongst those who have been refused licenses, but this was only to be expected. No matter how necessary restrictions are they will always be criticised in a democratic community, but we feel that the restrictions imposed have been based on sound scientific, economic and moral grounds.

Senior Inspector J.E. Munro visited Carnarvon and Shark Bay on May 10 to 17. He investigated certain complaints that prawns were being wasted, but found no evidence of this. In a detailed report submitted to the Director on his return, Mr. Munro said that he was impressed with the atmosphere of quiet efficiency evident in the prawn processing section of the Nor' West Whaling Company's Station at Carnarvon. He said that from the trawler, the prawns are offloaded in aluminium containers each of 50-lb capacity. They are taken on a diesel-powered trolley-train to the factory where, after weighing, they are dipped and washed at the beginning of the moving production line. They are then picked up on a conveyor belt and are "headed" by women operators standing on either side of the belt. The "headed" prawns are then taken through a washing bin and carried by conveyor-line to graders where they are cleaned and graded and packed in 5lb packs for snap freezing. Mr. Munro said that he found the crews of the well-designed trawlers co-operative, happy and optimistic. The gear being used consisted mainly of synthetic nets although some

cotton was in evidence due to a present-day shortage of synthetics, but all boats were enjoying excellent catches. After each haul the prawns are sorted on deck into king and tigers - the former constituting the bulk of the catch. They are then stored in the aluminium containers and are chilled with crushed ice. Brine is not used.

Mr. Munro reported that at Denham, some trouble in using converted boats had been experienced but these and teething troubles in the production line had largely been overcome. Although the trawlers were operating over distances similar to those travelled by the Carnarvon-based fleet, the use of converted boats and gear tended to generate problems which were not encountered at Carnarvon. The Denham trawlers were still using block ice, which was less satisfactory, but they intended to switch to crushed ice in the near future. The company at Denham, Planet Fisheries, was said to be concerned at the possibility of freezer boats buying prawns from licensed fishermen, and the skippers themselves voiced some grumbles to Mr. Munro. He concluded by adding his opinion that, considering the disabilities under which the Denham set-up first laboured - converted trawlers and gear, inexperienced crews and less sophisticated shore arrangements - the overall situation was satisfactory and a very good pack was being produced.

It is expected that the decision to station the p.v. "Vlaming" in Shark Bay to keep an all-night watch on the grounds closed to trawling will be well received by all engaged in the industry. It is inevitable that whenever restrictions are made there will be those who attempt to circumvent them, clandestinely or otherwise. The Department would be failing in its duty if it neglected to police conservation measures - particularly when they are as important to the State and to individuals as these are.

SOUTH-WEST ITEMS

On his return from an inspection of the Bunbury District, Supervising Inspector J.E. Bramley reported a number of matters of interest. They included the following :-

- Huge schools of salmon were seen off shore at Hamelin Bay. Fisherman Nick Soulas, on May 10, ran a net around a school estimated at 40 tons, but sharks tore the back out of the net, and all but 8 tons escaped.

- Although they were plentiful at Hamelin, there were no salmon schools at Eagle Bay.

- While herring were taken freely on hand lines at Busselton, and off the Mandurah reefs, they were not in schools and catches by professional fishermen were very poor. The same situation was reported, incidentally, by Senior Inspector A.K. Melsom to obtain in the Fremantle district.

- Small crabs and trumpeters infested Leschenault Inlet. Mr. Bramley said that the big hauling net of the Soulas family was hung from end to end with small trumpeters and with small crabs in the 2 to 3inch mesh in use.

- Silver whiting were plentiful in Leschenault Inlet and mullet and yellow-eye mullet and whiting were observed in considerable numbers outside the cut waiting to enter the Inlet.

- Tailer and mulloway were in good supply on the northern beaches.

PRESERVATION BY IRRADIATION

Under this heading we published in the March, 1963, issue of this Bulletin a comment by the Commissioner of Public Health on the advantages and shortcomings of this

new technique.

The gist of the Commissioner's remarks was that when this method of sterilisation was accepted for use on foods the whole food industry would be revolutionised and freezing and canning would virtually disappear. He pointed out, however, that at the present time the techniques had a serious disadvantage in that they denaturised proteins and destroyed some vitamins. Also, food submitted to radiation had been associated with toxic manifestations. Taste changes were also stated to take place in a number of foods.

It is of interest to note in the March, 1963, issue of "Fishing Gazette", published in New York, that the United States Atomic Energy Commission has announced that it is negotiating a contract with an American firm (Associated Nucleonics Inc. of Long Island, N.Y.) for architect-engineering services relating to construction of a marine product development irradiator at Gloucester, Mass. The article says that this facility will be used to demonstrate the technical and economic feasibility of pasteurization of fisheries products by irradiation. The plant will operate on a near-commercial scale and will process sea foods at the rate of one ton an hour, using a 300,000-curie cobalt-60 radiation source. It will cost an estimated $600,000 and will be finished late in 1964.

The programme being conducted by the A.E.C. is directed towards extending the refrigerated storage life of fresh products, such as fish, from several days to several weeks by radiation pasteurization. It is hoped to develop techniques for freezing and storing, without undesirable change, products such as soft-shelled clams. The "Fishing Gazette" states authoritatively -

> "Food successfully pasteurised by radiation does not lose its characteristic appearance, taste, or odour, but does have a longer refrigerated shelf-life. The energy-gamma radiation -

> emitted by the radiocobalt passes through the food-destroying bacteria and other spoilage-causing organisms. With a reduction of more than 95% of the bacteria as a result of the process, sea foods such as haddock, clams, or shrimp can be kept in ocean-fresh condition for more than four weeks under normal refrigeration. Taste panels have judged the effects to be excellent, and research results to date indicate that low dose radiation pasteurisation does not affect wholesomeness or nutritive value of the food."

ENVIRONMENTAL CONSERVATION

The importance of conserving our natural resources, of which our fauna is an integral part, is often overlooked by policy-making agencies. We who are responsible for conservation tend to overlook that an appreciation of the need for conserving natural resources - especially those which are renewable - is not quoted in the programmes for training industrialists, economists and accountants. This was brought home recently when an officer of another Department described fauna conservation as one of the Government's "hobbies". That an otherwise well-informed officer could hold such an outmoded idea is a reflection on this Department for its lack of a proper public relations programme. The need to develop such a programme is perhaps best instanced by a comment such as t at made by Dr. R.F. Dasmann in his university text book "Environmental Conservation," in which he said,

> "The importance of our having a knowledge of the principles of conservation of natural resources is simply this: how we treat our natural resources will determine the future of mankind. It is within our power today to take a course

> of action toward our resources and our human populations, which will force us in the future to live at a mere subsistance level if we survive at all. It is also within our power to take those steps which will help to guarantee a future of abundance for all."

Many other writers have pointed out the values of wildlife, and as early as 1945 the estimated capitalised value in cash to the United States was conservatively estimated by Gabrielson to be $14 billion - or, in present-day Australian currency about £6,000,000,000. Other writers, far from disagreeing with this colossal estimate, have pointed out that it does not tell the whole story. In another text-book, "Natural Resources", H.P. Taylor points out that it does not "for example, include the wildlife not used for game or food nor the benefits rendered the streams, fields and forests by insect-control through the agency of fishes, birds, mammals, and reptiles. It is pretty generally realised, and it should not be forgotten, that the plants and animals, altogether, constitute nature's board of equalisation, helping to keep things in balance so that the machinery will operate." Nor, as O.J. Muric wrote, does it include "such things as happiness, the good life, the elation that comes from being in high country in free, wild surroundings." Taylor suggests that Gabrielson's estimate should be increased tenfold! Whether or not we accept these figures it is clear that if we were limited to pointing out its value in terms of cash alone, a very impressive case could be presented.

Professor Shirley Walter Allen, in his book "Conserving Natural Resources", points out that "in terms of modern technological development the extension of a city or an industrial area may appear to be more urgent than maintaining forest, vacant land, or even farming areas which would support wild animals. When the chance arises to raise cash crops by draining a swamp rich in wild animal resources,

the animal life may seem unimportant. And certainly the impoundment of water for the various defensible purposes of power, irrigation, flood control, or even municipal water supply, may mean the doom of many animal forms whose favourite habitat will be buried under water. Similar alternative situations could be multiplied almost without limit. A blunt query 'What do you want, payrolls or fish?' was reported a few years ago during a State campaign against industrial steam pollution. That is over-simplification at its worst, but the rejoinder might well be, 'What will it cost to have both?'."

Many books have been written and many more will be written to explain the values of wildlife to man. We have to realise that as long as each individual animal does not carry a price-tag indicating its particular value to mankind there will be those who think it is worthless! We may rest assured, however, that there is always some argument which can be used to convince even the most stubbornly ill-informed. We have to search continually for these arguments, and bring them with whatever force lies within our power. The Australian wildlife heritage is unique. It is 100% Australian; it does not belong to us individually, nor to the community which at this time inhabits Australia. Being irreplaceable is not ours to waste or liquidate. We hold it in trust for future generations of Australians - indeed for all the peoples of the world for all time.

FAUNA NOTES

Inspector E.I. Forster has reported an unusual sighting at Fremantle on April 30. It was of a kingfisher, which he saw sitting on the bow of a dinghy about 30 feet behind the p.v. "Misty Isle" in the Fremantle fishing boat harbour. Mr. Forster said that the plumage of this bird seemed more dull than usual. It

stayed on the dinghy for about 20 minutes, during which time Mr. Forster had it under observation through binoculars, but then it flew off east across the Bay.

The "Handbook of the Birds of Western Australia", referring to the Sacred Kingfisher (Halcyon sancta), states - "Though this species, one of the wood or forest kingfishers, is normally an insect-eater, the ancestral habit of aquatic feeding may be called forth when the appropriate stimulus is present".

* * *

Feral domestic pigeons (Columba livia) have been more noticeable in the metropolitan area in recent months. On May 21, Fauna Warden S.W. Bowler observed two flocks of about 30 birds in all on the Swan River foreshore between the Canning and the Narrows Bridges. Although observations have been maintained along this stretch of foreshore for 13 months, this was the first time that feral pigeons have been seen there.

* * *

Another unusual sighting was reported by Supervising Inspector J.E. Bramley. On May 12, in Fremantle Harbour proper, he saw a large hair seal.

MARKETING OF CRAYFISH

Last month the local press devoted a considerable amount of space to opinions expressed by various persons and authorities on proposals to put the marketing of crayfish on an organised basis. In the House of Representatives on May 9, Mr. H. Leslie claimed that the crayfish tail export industry, worth between £5,000,000 and £6,000,000 a year,

was in jeopardy. He went on to say that it had been wrongly stated that local fishermen received too large a proportion of the market price obtained when the tails were sold in the United States. This, Mr. Leslie said, was not so. Nevertheless, he requested the Minister for Primary Industry to invite fishermen, processors and distributing companies to confer to see whether something could be done to place marketing on a firm basis.

In view of the opinion quoted by Mr. Leslie, it is of interest to note prices and comments published in American trade magazines earlier this year on the American production of spiny lobsters, which are taken mainly on the Florida Reef from Miami to Dry Tortugas. The best of those grounds are said to be the reefs and keys of the south, from which Florida fishermen earn more than $US.1,000,000 a year. One monthly figure quoted was $372,000 in November, 1962. The January 1963, issue of "Fishing Gazette" reported that the prices paid were constant "with Upper Keys' fishermen receiving about 40 cents per lb for their catch, and Lower Keys' fishermen getting approximately 2 cents to 3 cents per lb less." This appears to be about one third of the price paid on the New York market for live lobsters, which we presume command a similar price per pound. As the price of Australian tails on the American market at the same time ranged from $1.20 to $1.65, the prices paid to West Australian fishermen do not seem to be any higher than those received by their American counterparts, although the marketing costs would be greater for our products.

It has often been stated that "midget" tails are not profitable to exporters. Remembering this and the growing importance of the Brazil product on the American market, it is of interest to note the prominence given in a trade journal to a report that the Atalanta Trading Corporation of New York is now marketing two new retail lobster tail packs as a result of a nation-wide survey amongst both retailers and consumers. The two sizes are an 8-oz. package containing two tails, and a 20-oz. carton containing 4 to 6 tails, which are said to provide the retailer with a balance line to satisfy all consumer needs.

Harry W. Kaufman, Atalanta's vice president in charge of seafood, says;

> "These two sizes give the retailer a chance to price our rock lobster tails at realistic levels attractive to the consumer. Moreover, the tails we are marketing are imported from Brazil, the fastest growing lobster-producing area in the world, and are carefully selected for quality to satisfy the fastidious American palate. These two packages will really move."

Whereas it used to be said that Australian tails designated "South African tails" were being sold retail at premium prices, it has lately come to notice that Brazilian tails are now frequently retailed as Australian, and thus securing a distinct price advantage.

SWAMPHENS CAUSE DAMAGE

Although their eastern States counterparts are often classed as pests, we have only two records of the Western Australian species of Swamphens, Porphyrio porphyrio, causing damage to agriculture. These birds are normally shy and secretive. The first report of damage was forwarded to us by Honorary Warden A. Hinge, of Harvey, in a letter dated April 30, 1960. He advised that the birds were then causing considerable damage on the farm of Mr. D. Collela, whose property adjoined the main highway just north of Harvey. The report was forthwith investigated by Fauna Wardens S.W. Bowler and N.E. McLaughlan. The officers were shown two paddocks, each of about four acres, where the birds had been uprooting rye and clover grasses. It was said that about 250 of the birds were located in a swamp which fringed the property. Its area was about 50 acres.

A few days later, at 4.30 in the afternoon, they called again and saw the birds

uprooting grasses in the paddocks. They positively identified the birds as swamphens. The wardens commented that many of the birds were immature, but added that judging by the numbers in the paddocks, the swamp must have been an excellent breeding place. The owner stated that he had tried scarecrows and firing shots to frighten the birds away, but without any success. Presumably the damage ceased in that instance for no license was sought or issued. In fact, no further complaint has been received from Mr. Collela.

Early this month, however, Mr. Bowler investigated a complaint made by a Mr. A. Salleo, of Cannington, that swamphens were damaging his market garden. Mr. Bowler found that over a hundred tomatoes had been partly eaten, while 35 tomato plants had been knocked down by the birds on this 5-acre garden. At the time of his visit, Mr. Bowler observed 11 swamphens eating the tomatoes, but Mr. Salleo told him that at times there were up to 40 birds in the garden. A short-term permit to allow Mr. Salleo to destroy a few of the birds was issued, but further visits will be made to check whether the damage continues.

It might be only a coincidence that these isolated instances have occurred at the same season of the year, but one almost automatically assumes it has been caused by a seasonal shortage of natural food.

GEAR RESEARCH UNITS.

In the April, 1963, issue of this Bulletin we published (on page 77) a note headed "Commonwealth Establishing Gear Research Unit".

Advice from Mr. C.G. Setter, Director, Fisheries Division, Department of Primary Industry, Canberra, advises that so far little progress has been made by C.S.I.R.O. and his Department towards the establishment of the unit. Because of more urgent commitments, an officer who was to have obtained information overseas on gear research units has been allocated to other duties. It is not known therefore when progress in this matter may be expected. Mr. Setter added,

> "....there is no foundation in the rumour that steps are being taken to appoint personnel to the gear research unit."

THE FOLLOWING FISH WEIGHTS MUST BE EXCEEDED BEFORE A STATE RECORD CAN BE CLAIMED

REVISED, JANUARY, 1963.

Species of Fish	Line Record	Spear Record
Baldchin Groper	open	18lb.6oz.
Barracouta	4lb.6oz	5 lb
Barramundi	30lbs	21.lb
Bat fish	open	10.lb.8oz.
Black Bream	5.lb	5.lb.5½ oz
Black Drummer	5.lb	8.lb.8oz
Black Kingfish	open	45.lb
Black Snapper	open	15.lb.15oz
Blackspotted cod	open	45.lb
Blue devil	open	2.lb
Blue groper	65.lb.4oz	85lb
Blue mackerel	1½lb	open
Blue whaler shark	74.lb.12oz	-
Boar fish	open	6½.lb
Bonito	open	open
Box fish	open	1.lb.10z
Bronze whaler shark	381.lb	-
Brown Trout	5.lb.14oz	-
Butterfish	12.oz	open
Carpet shark	99.lb.12oz	
Cobbler	4.lb	3.lb
Cockatoo Morwong	open	10.lb
Coral Cod	open	7.lb
Crayfish	open	9.lb
Dusky Morwong	open	29.lb.12oz
Flathead	4.lb	6.lb.4oz
Flounder	1½.lb	open
Garfish	13.oz	open
Gurnard	open	4.lb.8oz
Grey nurse shark	176.lb	
Hammerhead shark	20.lb	-
Harlequin fish	open	8.lb.8oz
Herring (Tommy ruff)	1.lb.2¾oz	open
Herring cale	open	10.lb
Hump-headed wrasse	open	14.lb.4oz
Jewfish	42.lb.8oz	53.lb.4oz
John Dory	open	open
Leather Jacket	3.lb.15½	5.lb.9½oz
Long Tom	3.lb	open
Luderick	1.lb	open
Magpie morwong	open	2.lb.12oz
Mangrove Jack	open	3.lb.2oz
Moray eel	open	2.lb.15½oz

Species of Fish	Line Record	Spear Record
Mulloway	64.lb	70.lb
Mullet (Yelloweye)	1.lb	open
Mullet	3.lb	5.lb.8oz.
Nannygai	open	6.lb
Nor'West cod	open	285.lb
Nor'West Snapper	open	7.lb.2oz
Old Wife	open	1.lb
Pike	7.lb.12oz	3.lb.12oz
Parrot fish	open	14.lb
Porcupine fish	open	5.lb.8oz
Port Jackson Shark	74.lb12oz	-
Queen snapper	18.lb	17.lb.12oz
Rainbow Trout	7.lb.4oz	closed
Redfin Perch	3.lb.3½oz	1.lb
Red groper	5.lb	4.lb.12oz
Red Morwong	open	5.lb.12oz
Red Mullet	open	2.lb
Red parrotfish	open	8.lb.8oz
Rock cod	3.lb	open
Samson fish	91.lb	98.lb
Salmon	11.lb.12oz	12.lb.8oz
Sergeant Baker	3.lb	2.lb.8oz
Scaly fin	open	3.lb
Shovelnose ray	79.lb	open
Silver bream (tarwhine)	3.lb	3.lb
Silver drummer	26.lb	29.lb.8oz
Skipjack blue	12.lb	11.lb
Skipjack golden	40.lb	51.lb
* Spanish mackerel	55.lb.8oz	36.lb.8oz
Snapper	35.lb.5oz	6.lb
Snook	1.lb.8oz	open
Stingray	120.lb	open
Sweep (Banded)	2.lb.8oz	17.lb
Sweep (Ocean)	5.lb	5.lb.12oz
Sweetlip	5.lb	23.lb
Tailor	13.lb.9oz	8.lb.8oz
Tessellated Rockcod	7.lb.8oz	open
Threadfin Perch	open	29lb
Threadfin Salmon	open	12.lb.12oz
Tiger cod	open	3.lb.12oz
Tiger shark	37.lb	-
* Tuna(Southern bluefin)	6.lb.14oz	2.lb.8oz
* Tuna(Northern bluefin)	38.lb.8oz	7.lb
* Tuna(Yellowfin)	open	open
Turrum	open	63.lb
Viniculum	open	3.lb.10oz
White fish	open	open
Whiting(spotted or King George)	3.lb	4.lb.8oz

Species of Fish	Line Record	Spear Record
Whiting (Silver, sand or school)	1.lb	open
Wirrah	open	6.lb
Yellowtail (River or sprangled Perch)	8.oz	open
Yellow Tail Kingfish	78.lb.8oz	50.lb.8oz.
Zebra fish	open	3.lb.8oz.

The word "open" means that no application has been made for a record of this species since the inauguration of the current system in 1959.

* The W.A. Game Fishing Association has recorded heavier fish, but so far we have been unable to get their co-operation in fish recording to accepted standards.

PUBLIC WORKS DEPARTMENT PETROL & OIL SUPPLIES

A circular letter from the Under Secretary for Public Works contains advice under the above heading which in view of its wide application is reproduced in full.

"For the purpose of simplifying the rendition of accounts, will you please request all officers requiring petrol or oil in the undermentioned Districts and towns, to obtain same from Public Works Department Branches (not Main Roads Department District Offices) at the addresses shown hereunder :-

District	Town	Street
Albany	Albany Mount Barker	Kelly Ormond
Bridgetown	Bridgetown Manjimup Margaret River	Steere Rose Willmott
Collie	Collie	Throssel
Geraldton	Geraldton Moora Mullewa Three Springs	Shenton Row Main Slaughter
Harvey	Harvey Busselton Waroona Logue Brook Roelands Pinjarra	Becher Queen Bunbury Highway At Damsite Hayward District Office Mandurah Road
Kalgoorlie	Kalgoorlie Southern Cross Esperance	Hannan Sirius
Merredin	Merredin Kellerberrin	Mitchell Leake
Narrogin	Narrogin Katanning Lake Grace Pingelly Wagin	Earl Beaufort Franks and Bennet Queen Ultra
Northam	Northam Wyalkatchem	Fitzgerald Koorda Road

For issues after 1st July next, all accounts will emanate from our District Offices, as listed, and will be forwarded direct to the Office (W.A.G. Vehicles) or officer (Private Vehicles) receiving petrol or oil.

One of the objects of this change of procedure is to eliminate the processing of accounts through two Head Offices. Will you please bring this circular to the notice of Officers concerned.

J. McConnell

UNDER SECRETARY FOR
COUNTRY WATER SUPPLIES.

From 1-7-63

District Branches are to cease.

NUMBAT.

The publication in the "West Australian" of May 3, 1963, of a photograph of a woman and her daughter holding a numbat or banded anteater (Myrmecobius fasciatus) recorded the occurrence of these rarely seen animals at Chowerup. Incidentally, as she had committed an offence by taking the creature, the woman concerned was contacted by telephone and advised that she must release the numbat at the point of capture if she wished to avoid prosecution (Fauna Warden S.W. Bowler has since established that the animal was indeed released). A further report of the occurrence of these creatures has been received from Mr. E.J. Handley, of The Avenue, Harvey. He writes that in the last week of May he was travelling along the road to Tallanalla, when two miles east of Mornington Mill he saw a numbat cross the road. He added that it was at the same place that he had seen two numbats about seven years previously.

WESTERN AUSTRALIAN LINE AND SEA FISHING RECORDS.

Mr. P.G. Yewers, of Head Office, himself a leading spearfisherman, advises

that the table at pages 155 and 156 has been drawn up by the W.A. Fish Records Council. He adds that although these weights are authentic, many of our State records have not been recognised as Australian titles. However, in due course, an agreement is expected following which a list of Australia-wide records will be published. In the meantime the Western Australian list is reproduced here because of the wide public interest in such details.

DIVING FOR CRAYFISH

On page 122 of the previous issue we published this Department's views on diving for crayfish. Briefly, we rejected a request from the Geraldton Professional Fishermens' Association that this method of taking crayfish be prohibited.

The last issue had scarcely been published, however, when we received the February, 1963, issue of "The South African Shipping News". Under a heading "Rock Lobster Diving", it printed an article advising that new and strict regulations for the control of diving for rock lobster off the South African coast were contained in a new schedule of amendments to the Sea Fisheries Act and Regulations. It reported that the amendment described "diving" as "the practice of diving below the surface of the water with or without the use of equipment of any type designed or generally used for the purpose of facilitating swimming or diving under water". A new regulation stipulates that "no person shall capture or attempt to capture, disturb or remove any rock lobster by means of diving". It provides that this method of fishing may be done from the shore without a permit if the diver takes not more than 5 fish a day for his own use. A diver fishing for others but not selling his catch may obtain a permit to take up to 15 rock lobsters a day. Boats have been prohibited from carrying diving equipment, and if any rock lobster is found on a boat having that equipment it will be presume that they were caught by means of diving.

CLEARING HOUSE

NOR' WEST PRAWNS IN DEMAND

(by Max Butel)

Nor' West prawns from Carnarvon (Western Australia) were rushed by buyers when the first of new season supplies reached the Sydney fish trade this month.

Early reports are that the quality of the prawns is "better than ever" - a high tribute from the tough Sydney trade.

The most outstanding feature of the pack is the uniformity in size of the prawns.

Nor' West prawns are marketed by the Nor' West Whaling Coy and distributed throughout Australia by the W. Len Johnson outfit.

Nor' West went into the prawn business for the first time last year and is increasing the size of its fishing fleet.

In addition, the company recently chartered the N.S.W. trawler Friendship (skippered by Ron Montford of Evans Head) to make a six-months survey of New grounds in Shark Bay and off Carnarvon.

The private survey follows similar work carried out by the C.S.I.R.O. and the W.A. Fisheries Department.

When Nor' West went into prawns last season, the firm's managing director, Mr. R.B. Moore, said freezing works and a processing plant would be built at Carnarvon and that these facilities would be available to all fishermen in the area.

(Fish Trades Review Sydney May, 1963)

WASHINGTON COMMENT

(by Larston D. Farrar)

Fishermen (who already are considered "farmers," or "harvesters," in many government areas) some day may be sea farmers

in earnest, with great areas under their jurisdiction, in the view of Philip B. Yeager, member of the professional staff of the U.S. House of Representatives' Committee on Science and Astronautics, writing in the latest Smithsonian Institution annual report.

"Hydroponic farming - growing plants and vegetables in water containing the essential nutrient salts, rather than in soil - is in its infancy," Mr. Yeager notes. "But there are those who foresee that this endeavor will necessarily become a very large one and that research into the qualitative transformation and manipulation of sea water will make it possible."

This research field will become of much greater importance as available cultivable land grows scarcer, while the human population which must be fed doubles or triples by the end of th. century, the report noted, adding that the seas will become the world's refrigerator for food storage, too.

"As research into the sea and sea-related activities increases, industrial uses will be found for it which today we cannot visualize," Mr. Yeager asserted. "Recent developments promise a revolutionary shift to sea storage for commodities which need to be maintained in cool, stable temperatures. As land becomes even more scarce, and costs of using it for storage less feasible, it will not be surprising if government and commerce alike begin charting off segments of ocean areas for this purpose... New professions, unconjectured as of now, are bound to grow with these new industries."

(Fishing Gazette New York April, 1963)

A NATURALIST'S NOTEBOOK.

(by Eric Hardy, F.Z.S.)

Pollution is now a subject of ever-increasing complexity, and the fear of future contamination of the sea by radiation, with secondary pollution of plankton and fish-life, keeps British and American observers vigilant on both sides of the Atlantic.

Over ten years ago, Black and Mitchell informed the Marine Biological Society of from nine to 21 micrograms of concentrated zinc per litre in British inshore waters, and others have shown that radio-active zinc-65 is taken up by diatoms in the marine plankton of fish-food like Nitzschia, as well as by fish and shell fish, much, but not all of which, is lost again.

However, the research ship Seascan, operating in the Irish Sea to check any influence of waste from the Calder Hall atomic station passing out to sea from a plastic outfall pipe, has not, I understand, found anything other than the iron of fishing gear to register faintly on its geiger-counters.

It was interesting to receive from Washington a new U.S. fishery bulletin by the Government biologists Baptist and Price, dealing with the accumulation and retention of cesium-137, a well known radionuclide, by American flounders and other marine fish like tuna.

Although the American Atlantic flounder is a different fish from ours of that name, it is, nevertheless, a flat fish of similar biology, and our own flat fish would react similarly.

They found that the fish readily accumulated experimental doses of this material, either direct from contaminated seawater or from eating contaminated food. The faster the fish were growing the slower was the rate of intake. Highest concentrations were in the heart, liver, etc., less in the flesh, skin and bone.

In three months young flounders accumulated nine to eleven times the amount of cesium in sea-water, they showed. Clams and oysters concentrated six times the sea content in 20 days.

As shown in earlier work on fish and shell fish acquiring radio-active zinc from the sea, large amounts are taken up, causing a high blood-concentration of it in fish feeding on contaminated food-chains, but this quickly declines, whereas the accumulation in bone and flesh is slower to decline, and a small percentage is eventually retained.

The latter is the vital factor so far in all research on possible fish contamination by radio-active material.

Radio-Active Tags

There are, of course, safely small amounts of radio-activity. American fishery studies of Pacific herring, for instance, use radio-active tags for quicker identification of marked fish. Three such tags were recovered last year in the rejection equipment of a herring reduction plant; but they are having some difficulty in developing suitable means of "scanning," detection and rejection of such tagged fish in the factory production lines.

Ichikawa and Ogur, of the Japanese Society of Scientific Fisheries, have recently studied the strontium-calcium absorption by fish gills.

Considerable "concentrations" of zinc were found off Finland, and others in Tokyo Bay and the Gulf of Mexico.

So far, the explosion of nuclear bombs and the discharge of low-level atomic power waste have made negligible contributions to the total radio-activity of the sea, but such things are increasing annually.

(The Fishing News London March 29, 1963)

TOKAI SCIENTIST'S PROTEIN FIND

A Scientist working for the Fishery Agency's Tokai District Fishery Research Institute, Japan, has come up with a method by which high quality animal protein could be obtained by "liquefying" fish.

He is Hideo Azuma, chief of the Utilisation Department of the Institute, and recently he succeeded in an experiment aimed at creating protein-rich food by liquefying fish.

For the past 20 years, Azuma has been engaged in the study of processing fish powder.

Two years ago he hit upon the idea of liquefying fish protein and started research on the feasibility of "melting" fish meat with enzyme.

In his experiment, Azuma placed chopped fish meat in enzyme liquid for a period of one to three hours. The result was the complete dissolution of the meat and its change into a soup-like liquid.

The bones and calcium carbonate in the liquid were separated by placing the liquid in a centrifugal separator. The oil in the remaining liquid was then eliminated and the clear fish liquid was placed in a mixing machine under high temperature. Following this process, the liquid was placed in a concentrator and changed into a sticky and thick candy-like liquid. This was the end product.

This liquid can be consumed in various ways. It could be thinned out into a delicious drink or into powder form. It is rich in protein and contains vitamin B, minerals and other food extracts.

(The Fishing News London March 29, 1963)

HOW TO KEEP PLANKTON ALIVE FOR RESEARCH

The mystery of marine life from the plankton stages through to a recognisable juvenile form is being revealed to scientists at Victoria University of Wellington because of a discovery by Mr. R. Wear, a graduate research student in zoology.

The discovery proves that planktonic crustacea can be kept alive for up to four months by feeding the animals with minute quantities of freshly-crushed mussel, and so allowing scientists to watch their development through the various stages of moultings.

"This discovery opens the plankton programme to levels of research I had not envisaged," Professor L.R. Richardson, professor of zoology at Victoria University, said. "I had expected many years of tedious research before

we would have an exact understanding of our plankton.

"I am now satisfied that the most difficult problems have become simple through Mr. Wear's discovery, and I am sure that the technique will be welcome in many other laboratories."

(The Fishing News London March 29, 1963)

THE MIGRATION OF FISH - 2

(by A.D. Woodhead, Research Fellow of the Zoological Society of London.)

Is it instinct?

It is often concluded that fish and birds find their way by "instinct", but this offers no explanation of the stimuli or clues which guide them. Many marine fish spawn buoyant eggs, which are carried in surface currents of the sea, and when the larvae hatch they may be many miles from the spawning area. Young fish, maturing for the first time, frequently swim through areas which they have never crossed before (except as floating eggs), yet they still arrive on the spawning grounds. It is sometimes suggested that older fish, having learnt the route, may lead younger fish, and certainly on many spawning grounds the old fish tend to arrive first - for example, the Norwegian Sea herring, the Barents Sea cod and the North Sea plaice. This suggestion implies that sufficient details of the route are imprinted in the memory of the young fish quickly, so that they can later become leaders. Rapid learning of this special type, although on a very much smaller scale, has been demonstrated in some fish; similarly young racing pigeons learn to "home" more quickly if they are first released with older, experienced birds. However, virgin Spawners arrive

first in some stocks, such as the herring spawning in the Straits of Dover; again, Barents Sea cod which first migrate from the Spitzbergen shelf to Lofoten to spawn, often return as spent fish to the Murmansk coast area, so that they would later have to re-learn a completely new route to Lofoten, Eels and Pacific salmon spawn only once, then die, leaving no old fish to lead their long spawning migrations. For such reasons it seems simpler to abandon these hypotheses, and to look for other regular features in the environment which could guide the migrating fish.

It has been suggested that fish migrate along gradients of temperature or salinity in the open sea, and many fish are surprisingly sensitive, being able to detect changes in temperature as small as 0.03 deg. C. and salinity changes of 0.02 per cent. However, such gradients in the sea are often slight; thus, although the Barents Sea cod passes from colder to warmer waters on its spawning migration, the total temperature change is only about 7 deg. C., spread over 600-800 miles, so that the fish would have to swim about 30 miles on average, before encountering the minimum change which they could detect. The same arguments apply even more strongly to salinity changes.

Sense of smell

The most sensitive chemical sense in fish is smell and in some species it is very fine indeed. Eels have been trained to detect at least one chemical in dilutions greater than one part in a billion parts of water, and several species of fish can certainly distinguish between waters from different streams, even when these have been diluted some thousands of times. Smell may help migrating salmon to find their home stream; if these salmon are transplanted back into the main river system, they soon find their way to the home stream again, but if their nostrils are blocked with cotton wool many transplanted salmon lose this ability, apparently because they cannot smell out their home stream. The scent of the home stream must be carried several miles in coastal waters,

and migrating salmon may move up and down the coast until they pick up this scent. Because of their extensive migrations, the homing abilities of salmon seem most spectacular (although very many salmon undoubtedly get lost and spawn in other streams), but over 30 other species of fish have been shown to be able to "home" accurately, on a smaller scale. Marine fish may also recognise their spawning areas by a characteristic scent of some sort; this could explain, for instance, why plaice from each of the three main spawning grounds in the southern North Sea return consistently to the same spawning ground. Similarly there are small differences in the herring which spawn on the banks around the Straits of Dover, the same type of herring apparently spawning annually on particular banks.

Do currents control migrations?

Water currents play a fundamental part in governing the distribution of fish. If regular water currents are present, fish might carry out migrations by passive carriage in the current, by actively moving against it, or by a combination of active movement and passive drift.

The eggs and larvae of many marine fish are carried from the spawning areas by surface currents, and frequently the spent adults are similarly transported back to the feeding grounds. Generally, mature adult fish must travel in the opposite direction to arrive at the spawning areas, and it has been suggested that such migrations are achieved by active movement against the current. However, the role of currents in orientating the migration of adult fish is by no means so obvious. In tidal areas, such as the North Sea, the current is the residual drift between the two opposite tidal streams, and is often small, so that a fish migrating against the current would swim a long way against tidal streams in order to make a little ground against the residual current, a seemingly inefficient method of migration. Furthermore, active movement against currents is beyond the capabilities of many small fish, such as sprats, which are unable to stem currents greater than about half a knot.

Eels

Young eels are carried passively in the open sea, their rate of movement being the same as the residual current. When they approach land, which they can smell in the water, they hold to the bottom on the ebb tide and come off on the flood, so that they are carried rapidly up into the river estuaries. This type of mechanism may occur more widely in fish; herring swim near the surface at night but return to the bottom during the day, similarly plaice and whiting tend to leave the sea bed at night. It should be relatively easy to calculate the distance which they should be carried in the tides during the night and to compare this with the observed movement of the fish; however, we have little exact information on how long these fish are off the bottom at night. Furthermore, fish do not behave in exactly the same way throughout the year; thus herring swim up off the bottom earlier in the evening during the first part of their spawning migration than later, while spawning fish only swim up when it is almost completely dark.

Larger fish, like cod, can migrate against prevailing currents with relative ease, and they might swim upstream, to the spawning grounds, orientated by steady oceanic currents; such currents could readily be recognised, since they would have a combination of characteristic features, scent, salinity, temperature, etc. However, detailed hydrographic surveys have revealed counter currents often running in the opposite direction beside or beneath the steady surface currents, so that even large fish might make use of these to be carried to the general spawning areas, later moving into the surface waters as spent fish to be transported back to the feeding grounds. Research is at present going on to determine exactly in which current systems the fish swim at particular times of the year.

Navigation by the sun?

It has been shown that migratory birds and insects can use the sun as a point of bearing

on their journeys. Rather surprisingly, experiments with sunfish, minnows and salmon have shown that they are also able to carry out a simple form of sun navigation. In field experiments, white bass living in a lake were taken from their shore spawning sites and released in deep water; generally the fish moved off in a northerly direction to reach the shore near their spawning areas. This only occurred on sunny days; when the sun was obscured the fish moved randomly. Marking experiments with eels in the Baltic showed that they migrate on a constant course, between S.W. and W.S.W. Pelagic fish moving in clear surface waters might possibly use some form of sun compass orientation, but sun navigation is unlikely to be of importance to deep water fish, or those migrating in winter.

What controls the migratory drive?

For part of the year, fish roam within their feeding areas but, at regular seasons, mature fish leave these grounds on their spawning migrations. Usually the environment in feeding areas remains relatively constant, so that a fundamental change in the fish behaviour must occur, causing it to migrate.

At first sight it might seem that spawning migrations are initiated by the ripening of the gonads. However, eels start to migrate before their gonads ripen, and salmon caught in the estuaries of British rivers in December may be within a month of spawning or might have undeveloped gonads and not spawn until the following November. Moreover, some juvenile fish carry out lengthy "dummy-run" migrations in the general direction of the adult spawning areas, although they are quite immature. Since spawning and "dummy-run" migrations occur in the absence of ripening, other internal factors must control the migratory drive. The winter migrations of the Barents Sea cod appear to be controlled by the activity of the thyroid gland, which lies in the throat. It becomes active in late September, as the cod begins its spawning migration, and its activity continues until spawning time; in spent fish the gland has become inactive again.

The activity of the thyroid thus coincides exactly with spawning migration.

These are ripening adult fish, but immature cod also show considerable seasonal movements, migrating some hundreds of miles south and west in winter and returning to the feeding banks in spring, while some of the oldest immature cod move almost to the adult spawning grounds. Thyroid activity in these immature fish again coincides with the winter migration, the gland remaining active for the longest time in the fish which migrate furthest. These findings suggest that thyroid activity may initiate and control the active winter migration both of the juvenile and the adult cod; it is therefore interesting that thyroid activity has also been found in other migrating fish, for example salmon and eels.

Of course, fish migrations are complex and certainly more than one gland is involved in their control. The thyroid is only one of a number of glands, all of which have marked effects on the functioning of the animal, and whose activity is co-ordinated by a "master" gland - the pituitary - which lies close to the brain. The pituitary is richly supplied with nerves, and its activity, in turn, is regulated by the nervous system. Much more work is needed in this new field; in particular we know very little about how the activity of such glands directly affects the behaviour of fish, although one action of the thyroid is certainly to produce an increase in the swimming speed and general activity of the fish.

Migrations of fish are often remarkable both for the extent of the journeys and for the ability of some species to home to particular spawning grounds from distant feeding areas. How the fish does this is by no means certain, but studies so far have clearly shown that the fish has a very efficient sensory system, enabling it to detect small chemical and physical changes in its environment. Indeed, the fish is endowed with a set of "instruments" with an accuracy which approaches those used by modern fishery

research vessels, and in some cases, surpasses them. However, it may be some considerable time before we know how the fish uses these natural conditions during its migrations. When the story is better known it seems likely that there will not be any single explanation of fish migration, but that a number of mechanisms will be involved in different species.

(World Fishing London April, 1963).

TERMINOLOGY

Recently I read part of a flood-control report of the Ontario Planning and Development Department, with excerpts from records going back to 1913, and noted that on-the-spot references to floods included such phrases as "fearful storms," "dreadful downpours," "incessant rainfall," "awful cloudburst," and "unusually heavy precipitation." This led me to wonder if one man's "dreadful downpour" might not be a more phlegmatic observer's "heavy precipitation" and whether more precise standards of grading wouldn't be helpful to hydrologists. It reminded me that one time in Georgia a farmer on whose land I was hunting bobwhite referred to a rainstorm as a "gully-washer." When I asked about the term he told me that by local parlance a very heavy rain was a "gully-washer." When I asked about the term he told me that by local parlance a very heavy rain was a "gully-washer," an exceptionally long and violent downpour was a "trash-mover," and that once every two or three years they would be visited by a cloudburst so cataclysmic that it would be acknowledged by common agreement to be a "hog-drownder."

(Field & Stream New York March, 1963)