

FISHERIES DEPARTMENT, WESTERN AUSTRALIAMONTHLY SERVICE BULLETIN

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STAFF NOTES

The Superintendent (Mr. A.J. Fraser) will visit the Eastern States at the end of this month. As President of the Civil Service Association, he will attend the Australian Public Service Confederation Conference in Melbourne. Mr. Fraser will take the opportunity to visit the headquarters of the Division of Fisheries, C.S.I.R.O., at Cronulla, and the offices of the Commonwealth and N.S.W. Fisheries Departments in Sydney.

The Supervising Inspector, Mr. J.E. Bramley, resumed duty after annual leave on September 12. During his leave Mr. Bramley visited Carnarvon and investigated facilities for the taking and holding of kangaroo tails for the export market. In October, Mr. Bramley will visit Bunbury in connection with the closed water boundary at the mouth of the Collie River, over which some dispute has developed.

The Senior Inspector, Mr. J.E. Munro, was in charge of the departmental exhibit at the Wild Life Shows held last month in Perth and Kalgoorlie. Attendances were a little down in Perth on previous years, although the show itself was of a high standard. Mr. Munro reported that the Kalgoorlie Town Hall was packed beyond capacity on two nights, and was extremely well patronised for the rest of the show. The departmental exhibit, which excited great interest, included a display of native weapons and domestic and ceremonial instruments loaned by the W.A. Museum, as well as the fisheries and fauna exhibits.

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Inspector W. Davidson returned to duty on September 30 after annual leave.

Inspector S.W. Bowler will commence annual leave on October 3. During his absence, Relieving Inspector A.K. Melsom will be in charge of the Mandurah district.

Inspector A.V. Green, of Albany, at present on sick leave, is expected to resume early this month. He will commence annual leave on October 31 and Mr. Melsom will go directly from Mandurah to take over the Albany district.

Cadet Inspector L.W. Duncan underwent an operation in Royal Perth Hospital last month, and is now recuperating at his parents' home at Bridgetown.

Assistant Inspector R.J. Baird completed his annual leave on September 29, and is at present assisting in the metropolitan district. From October 8 until mid-November Mr. Baird will assist in trout distribution.

Inspector N.E. McLaughlan is in Perth, having commenced annual leave on September 26.

Assistant Inspector T.B. Baines arrived in Perth on September 27 after completing his tour of duty at the Nor'West Whaling Company's station at Point Cloates. The company took the last of its quota of 500 whales on September 19.

Inspector G. Coombes will be on annual and accumulated leave from October 10 to November 17. He proposes to visit his parents at Iluka, N.S.W.

Miss Pamela Pegrum of Head Office will commence annual leave on October 3.

Technical Officer L.G. Smith has completed his September assignments under the estuarine research programme. This involved a visit to Shark Bay as well as to the South-West. Samples taken from the middle of July to the end of September will shortly be forwarded to Cronulla for examination. During October Mr. Smith will carry on the usual programme at Albany, Denmark, Bunbury and Mandurah.

PERSONAL PARS

Mr. J.B. Davidson, who is on a collecting tour for the Los Angeles County Museum, visited the Superintendent last month. After visiting the Abrolhos last April, Mr. Davidson journeyed overland to Darwin and joined some compatriots in big game hunting in the Northern Territory. He later flew to India and then to Africa where he travelled most extensively before returning by air from Johannesburg to Perth on September 13. During his travels, Mr. Davidson took over 2 miles of 35 mm. colour film and many thousands of colour slides. He has now left Perth again for Darwin, and expects to spend about a month collecting in the Northern Territory. From there he will visit the Eastern States and hopes to spend Christmas in Canberra. After visiting New Zealand, he will return to California about April of next year.

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Mr. E. de. B. Norman, Pearling Officer of the Commonwealth Fisheries Office, spent a few days in Western Australia towards the end of September. While in Perth he called on the Superintendent. He also spent a few days in Broome.

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Dr. K. Sheard, Officer-in-Charge of the W.A. Regional Laboratory of the Division of Fisheries, C.S.I.R.O., left Perth on September 8 to spend about 4 months abroad in the study of current research in the United States and Canada on crayfish and plankton. He will visit the Scripps Institute of Oceanography, La Jolla, California, as well as the Universities of Miami and Hawaii, and the Pacific Biological Station at Nanaimo, British Columbia, Canada. Dr. Sheard will present a paper at the annual conference of the Gulf and Caribbean Fisheries Institute, and hopes his studies will assist in the better understanding of Western Australian crayfish problems.

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INTERSTATE FAUNA AUTHORITIES' VISIT

The biennial conference of Interstate Fauna Authorities was held in Perth from September 20 to 23. Delegates attended from all States and the Northern Territory for the first time in the history of the conference. This made possible a very full discussion on current problems related to the administration of fauna conservation laws.

Most of the delegates arrived on Friday evening, September 16. The following morning they were taken to view the Wild Life Show at the Perth Town Hall. The delegates were keenly interested in all aspects of the Show and congratulated the organisers and expressed a desire to see a similar show held in their own States.

Accompanied by the Chief Warden of Fauna, Mr. A.J. Fraser, the Supervising Inspector, Mr. J.E. Bramley, Senior Clerk H.B. Shugg and Fauna Warden G.C. Jeffery, the delegates were taken on a tour of our forest country during the weekend. Mr. A.J. Milesi, a member of the Fauna Protection Advisory Committee and Fire Control Superintendent of the Forests Department, also accompanied the party and led them through the Dryandra Forest Reserve and introduced them to the resident forester in charge, Mr. J.H. Currie. The visitors were delighted to find that a numbat had been located previously by Mr. Currie's daughter, Jon, and its hiding place in a hollow log sealed up, pending their arrival. The log was opened and the numbat secured and photographed by the visitors. Mr. J.B. Higham, another member of the Fauna Protection Advisory Committee, joined the party at Dryandra and accompanied them to Pemberton where they arrived the next morning, after having stayed the night at Narrogin. The party was met by Mr. A.R. Kelly, President of the Pemberton-Warren Trout Acclimatisation Society and other prominent Pemberton citizens, and taken on a drive through local national parks and for an inspection of the trout hatchery and environs.

The party returned to Perth via Bunbury on Monday and in the evening gathered at the Palace Hotel, where a dinner had been arranged in their honour by the Minister for Fisheries (Mr. Kelly). Mr. Kelly presided and officially welcomed the delegates to the State.

Included among the guests were :-

- Mr. A.D. Butcher, Director of Fisheries & Game,
Melbourne;
- Dr. W.G. Bryden, member of the Fauna Protection Board
of Tasmania;
- Mr. F.J. Griffiths, Chief Guardian of Fauna, Sydney;
- Sir Edward Hallstrom, member of the Fauna Protection
Panel of New South Wales;
- Mr. F.W. Moorhouse, Director of Fisheries and Game,
Adelaide;
- Mr. C. Roff, Fauna Officer, Department of Agriculture
and Stock, Brisbane;
- Dr. E.P. Hodgkin, Department of Zoology, University
of W.A.;
- Dr. G.M. Dunnet, Officer-in-Charge, Wildlife Survey
Section, C.S.I.R.O., Perth;
- Dr. D.E. White, President, Royal Society of W.A.,
Department of Chemistry, University of W.A.;
- Mr. A.R. Main, President, the Naturalists' Club of W.A.;
- Mr. H.E.B. Smith, Chairman, State Gardens Board;
- Mr. L. Glauert, Director of the West Australian Museum;
- Mr. A.C. Harris, Conservator of Forests;
- Mr. A.J. Milesi, Deputy Member, Fauna Protection
Advisory Committee;
- Mr. V.N. Serventy, Education Department, Perth.

The conference proceedings were officially opened on Tuesday morning, at the board room of the Farmers' Union of W.A., by Mr. Kelly, who once more welcomed the delegates, particularly Mr. J.D. McConnell, representing the Northern Territory, who had arrived late the previous night.

The conference adjourned at midday and in the afternoon the delegates were taken to the South Perth Zoological Gardens and entertained at afternoon tea by the Chairman, Mr. H.E.B. Smith, and members of the Zoological Gardens Committee.

The conference discussions were resumed on Wednesday morning and adjourned to allow delegates to attend a reception by the Lord Mayor at the Perth City Council Chambers. In the afternoon the visitors were shown around the city and Kings Park and inspected the work being done on the quokka by the Zoology Department of the University of W.A.

On Thursday evening they attended a meeting of the W.A. Bird Group, held in the W.A. Museum. Mr. Butcher, Director of Fisheries & Game, Melbourne, gave a talk on fauna reserves and national parks in the United States, and showed a large number of kodachrome slides to illustrate some of the problems and the work being done on fauna conservation in that country.

Formal discussions of the conference were completed by midday on Friday, which allowed the visitors time to visit Yanchep Caves Reserve. They showed great interest in the koalas and indicated that the animals appeared to be at least as healthy as those in captivity in the Eastern States.

A symposium on fauna conservation was held in the Assembly Room of the Institute of Engineers, Gledden Buildings, Perth, in the evening. Four papers were read, the first by Mr. V.N. Serventy, representing the Royal Society and the W.A. Naturalists' Club, his subject being "Essential Requirements of a Conservation Programme". Mr. Serventy was followed by Mr. L. Glauert, Director of the West Australian Museum, who dealt with "Some Problems of Conservation". Mr. A.R. Main, Lecturer in Zoology at the University of W.A., spoke on the "Role of Pure Research as an Aid to Conservation" and showed how research work on the Rottneest quokka brought out facts which will be of benefit both in the control of pest marsupial fauna and in the conservation of rare species. Dr. G.M. Dunnet, of the Wildlife Survey Section, C.S.I.R.O., outlined techniques for the trapping and marking of fauna which provided considerable information on which to base ecological studies.

Those present, including the Eastern States delegates, joined in a general discussion which followed the reading of each paper.

Miss V.T. Hogan, of Head Office, and Mrs. M.E. Bell, seconded from the Town Planning Department, took verbatim notes on the conference discussions, from which a report will be prepared and published and copies made available for all those interested, including each staff member. Similar treatment will also be given the four papers presented at the symposium.

The Superintendent desires to record his deep appreciation of the really first-class staff organisation which made this conference such a success. The organisation fell largely on the shoulders of Mr. H.B. Shugg, and he is to be highly commended on his efforts. To Messrs Bramley and Jeffery, and to Miss Hogan and Mrs. Bell, he extends his thanks for a really worthwhile job.

SURVEY OF CARNAC ISLAND

A group of naturalists proposes to carry out a survey of the natural history of Carnac Island at the end of this year. The party will comprise 6 to 8 people, drawn from the Zoology Department of the University and from the W.A. Naturalists' Club. They will study the adjacent marine and island flora and fauna and will jointly prepare for publication in the "W.A. Naturalist" a report of their findings.

The lessee of the island has given his permission for a camp to be established and this Department has agreed to assist as far as possible with transport between the island and the mainland.

FISHERMEN'S ADVISORY COMMITTEE

A meeting of the above Committee will be held in the Fremantle Courthouse on October 13 and 14. Evidence will be taken from representatives of crayfishermen and other interested persons and organisations, in relation to the management of the Fremantle-Lancelin-Cervantes-Jurien Bay crayfish fisheries.

This will be the first meeting of the re-constituted Committee. It comprises Mr. A.J. Fraser, Superintendent of Fisheries (Chairman); Mr. N.K. Swarbrick of Albany, representing deep-sea fishermen; Mr. Frank Camarda, of Fremantle, representing crayfishermen; Mr. W. Matthei, of Yunderup, representing estuarine and beach fishermen; and Mr. Roland Smith, of Perth, as the representative of those not commercially engaged in fishing.

The meeting will open at 10 a.m. and past procedure will be followed whereby persons attending will be interviewed singly or in small groups. After considering all the evidence the Committee will make its recommendations to the Minister for Fisheries.

TROUT DISTRIBUTION

On September 10, Technical Officer J.S. Simpson, accompanied by Mr. I. Bartholomew of Head Office, left Pemberton at 2 a.m. to bring a load of fry to Perth for distribution. Unfortunately a fault developed in the outlet screen and most of the fish were sucked into the pump and destroyed. About 3,000 fry were distributed to those farmers who were unable to make arrangements to attend a fortnight later when a further distribution was promised.

On the second trip Mr. Simpson was accompanied by Cadet Inspector D. Wright, and apart from some delay due to a mechanical fault, a successful distribution was made. Demand greatly exceeded supply as only 20,000 fry were available.

Mr. Simpson will make deliveries totalling 160,000 fry to areas in the Great Southern this month. Centres to participate include Wagin, Kojonup, Tambellup, Gnowangerup, Nyabing, Kulin and Lake Grace. All the fry have been ordered for planting in farm dams. Mr. Simpson will be assisted by Assistant Inspector R.J. Baird.

ABROLHOS CRAYFISHERY

The Abrolhos crayfish season, which opened on March 15, closed in mid-August with a total catch of 2,472,144 lb. of crayfish. The statistics of this catch, together with statistics of the three previous years, are set out in the table on page 165.

The most striking feature of the table is the continued increase shown in the overall total. However, last season the Abrolhos fishery attracted

ABROLHOS CRAYFISHERY

	1952 SEASON			1953 SEASON			1954 SEASON			1955 SEASON		
	Total	Catch per man	No. of men	Total	Catch per man	No. of men	Total	Catch per man	No. of men	Total	Catch per man	No. of men
	lb.	lb.		lb.	lb.		lb.	lb.		lb.	lb.	
North Is.	132,437	16,555	8	123,243	17,606	7	208,972	13,931	15	278,681	15,482	18
Wallabi	441,684	22,084	20	573,081	22,041	26	679,783	18,883	36	717,699	18,402	39
Easter	579,773	18,118	32	647,967	16,199	40	814,848	19,784	41	802,879	17,082	47
Pelsart	395,556	16,481	24	294,020	17,294	17	415,797	19,800	21	672,885	14,952	45
TOTALS ..	1,549,450	18,446	84	1,638,311	18,203	90	2,119,400	18,756	113	2,472,144	16,592	149

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not only fishermen with scooter-type boats, fishing in the shallower, more protected waters, but also men with boats ranging up to 45 ft. in length, which worked outlying deeper waters. The result is that the catch figures do not represent only the weight of crayfish taken from the Abrolhos area proper, but rather the weight taken from an extended area including the Abrolhos. This trend was forecast last year when a number of larger boats fished outside the area, i.e., in the shallow reef areas and atolls of the four island groups, thus boosting the season's catch considerably. It is estimated that the catch in the Abrolhos proper was approximately 1.8 million lb. this year, which is just about the same as last year.

Looking at the overall figures, which must be considered in the light of the observations in the preceding paragraph, it will be noticed that the total number of men fishing has increased by 25%, while the total catch has increased by only 17%. The result is that the catch-per-man has decreased by 2,164 lb. to 16,592 lb.

The Pelsart Group, which was intensively fished in 1951, appeared over the last three years to regain some of its stability as the number of men fishing in this area decreased each year. However, with this year's influx of new men, the catch-per-man has again dropped to approximately the 1951 level. The Easter Group this year supported a somewhat greater number of fishermen than last year, with the result that the catch-per-man dropped sharply. The Wallabi Group remained fairly stable as regards the number of men, catch and catch-per-man, while the North Island area was the only area to boast an increased catch-per-man.

It would appear that while the take of the Abrolhos area proper remained stable, it was the number of the fishermen with the bigger boats who ventured into deeper water who were responsible for the increased catch.

The fact that the catch of the Abrolhos area proper has remained stationary, and the overall total catch boosted, is pleasing. However, the catch-per-man over the whole area is the lowest on record, while the number of men fishing has never been greater,

and these two facts alone are sufficient to cause us to continue the stringent regulations introduced some years ago for the proper management and conservation of this important fishery.

TASMANIAN SCALLOP SEASON

The scallop season closed in the middle of August, and both merchants and fishermen agree that catches have been better than normal, with over 400 tons being taken. The size of scallops this season has been much larger than in previous years. A fleet of some 80 boats dredged the various beds in D'Entrecasteaux Channel and other parts of the east coast. Two comparatively new beds were worked more extensively this season, one on the east coast and the other at the mouth of Eaglehawk Neck Bay. These produced scallops of a uniform size with good flesh. It is expected that the yearly catch during the next four seasons will be slightly less than this year's, but by 1959 the annual catch may possibly exceed this year's record.

Scallops take three years to mature and another three years before they attain the minimum regulation size. Their life expectancy is about 14 years. Most scallop beds are found at a depth of 4-7 fathoms. Although the season is short, the scallop ranks about fifth in importance in the Tasmanian fishing industry. They are in popular demand in this State and also find a ready market on the Mainland.

Several scallop beds have been found in Western Australia. One particularly (at Shark Bay) seems to offer possibilities, and one of "Lancelin's" first jobs after the prawn survey has been completed will be to survey all known beds.

INTERNATIONAL TRAINING IN FISH CULTURE

Advice has been received from the Commonwealth Fisheries Office that Mr. B.K. Bowen, of Head Office, has been selected to attend a fish culture

school in Indonesia. The school, which has been organised by the Food and Agriculture Organisation of the United Nations, in co-operation with the Government of Indonesia and Indo-Pacific Fisheries Council, will be held at Bogor and selected mainland fisheries centres of Java and Madura from October 31 to December 10 of this year.

The purpose of the school is to give advanced training to Government officers of interested countries in the protection, promotion and development of inland fishery resources. The programme consists of a series of lectures, together with laboratory work and practical demonstrations of various techniques.

The course comprises, among its many features, appraisal of resources, economic and social factors, management of natural stocks, methods and types of fish culture, and organisation and administration of the control of fish farming.

Mr. Bowen plans to leave Perth for Djakarta on October 27 by air via Darwin. FAO will meet the students' costs of attendance and board and lodging at the centre, travel costs within Indonesia and their return fare to the first convenient port of call in their home countries. All other expenses will be borne by the participating Governments.

SHARK BAY RESOURCES

For the last three weeks of July and the first two in August, the research vessel "Lancelin" was engaged in trawling for prawns and trolling for tuna at Shark Bay, incidentally to the whale-marking programme reported in last month's issue.

The trolling gear was rigged and tested on Inner Bar, South Passage. Trawls were made in Denham Sound which produced fair numbers of saucer scallops and blue-stripe and tiger prawns. From later trawls the same species were again taken off Dirk Hartog Island. On clay bottom east of Dirk Hartog Island, tiger prawns, blue manna crabs and a quantity of small fish were secured. Large quantities of tiger prawns from 5½" to 8" in length and a few blue-stripe prawns

were ~~trawled~~ in 13 fathoms east of the Gap, between Bernier and Dorre Islands. From these and other explorations, it seems that a commercial population of tiger prawns exists in this area. The prawns were similar in size and condition to the Exmouth Gulf specimens.

Other points of interest were the quantities of good condition blue crabs fished, the availability of small fish which could be used for live bait fishing, and the numbers of very immature snapper caught.

No trolling was carried out west of the islands forming Shark Bay, but a bumper season was reported for spanish mackerel, tuna and also snapper in that area. In Denham Sound, northern bluefin tuna and narrow-barred spanish mackerel were caught. Off Dorre Island, specimens of large-scaled tunny, spotted and narrow-barred spanish mackerel, northern bluefin tuna, large-scaled tunny and spanish mackerel were caught, as were northern bluefin tuna off Cape Peron.

A high-speed plankton net was streamed and tested up to 8 knots. It appeared to tow and fish well up to $6\frac{1}{2}$ knots, but higher speeds caused too severe a strain, the towing hoop collapsing and the net tearing. On one occasion a whale surfaced astern under the trolling lines and was hooked. Needless to say, it was not landed.

OYSTER FARMING EXPERIMENTS AT SHARK BAY

Inspector N.E. McLaughlan, of Shark Bay, is carrying out some experiments which should prove to be of particular interest to the Department and local residents generally. He has been supplied with material sufficient to erect 6 spat-catching trays, and has already erected the first in Gregory Bay at the northern extremity of Cape Peron. It is constructed of jarrah posts and cross members to which slats have been secured. At low tide it stands some four feet out of the water so as to be two-thirds submerged at high tide.

The material for the next five trays has been tarred and is seasoning while Inspector McLaughlan is on leave. Immediately on his return he will erect

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the remainder - one more in Gregory Bay and the others off the eastern shore of Dirk Hartog Island. The tray now in position is not tarred, for comparison of results. Mr. McLaughlan plans to use metal rods instead of slats on some of the other trays as an additional comparative test. He is not hopeful of successful results from the rods, as the oyster needs a rough surface on which to cling, and probably the metal will not rust sufficiently quickly to obtain good results this season.

In these experiments Mr. McLaughlan has found the "Handbook for Oyster-Farmers" (Division of Fisheries, C.S.I.R.O., Circular No. 3) of considerable assistance.

FURTHER PRAWN RESEARCH

The research vessel "Lancelin" is expected to leave Fremantle on October 8 for a third and final prawn survey in the Exmouth Gulf area during the coming summer.

The survey will continue for approximately six months and will extend over a period not covered by previous research. Other types of fishing will be investigated and "Lancelin" will during the first few weeks be accompanied by Mr. D.S. Hunt's fishing boat "Jon Jim", to enable the commercial possibilities of the area to be explored.

Captain H.C.W. Piesse will be in command of the "Lancelin". Assistant Inspector C.R.C. Haynes is to act as Mate, and Cadet Inspector D. Wright will be crew member.

Inspector R.M. Crawford has been temporarily transferred to the metropolitan district under Senior Inspector J.E. Munro, having served on the "Lancelin" for just over 2 years.

THE CLEARING HOUSE

Annual Raid on Migrating Eels Now Begins

Lines four miles long, set with a thousand hooks, are being prepared by 200 Irish fishermen, who each pay £4 a year for the privilege.

They are out to win £75,000 before January from a silver army of millions of Lough Neagh eels, on their migration to their breeding and dying grounds in the Sargasso sea.

Men like the two hundred who are now preparing their lines have fished Lough Neagh for many hundreds of years and, even today, they catch about two-thirds of all the eels from the Lough and the Bann river.

The other third goes to the Toome Eel Fishery Company, which has a 5,000 year lease, starting in 1905. The company maintains a series of trapping weirs between Coleraine and the Lough itself. Some are made of wattles or sleaghs. A series of V-shaped funnels is run across the Bann, pointing upstream. Each ends in a 10ft. opening, into which is set the cog hill net, 14 yd. long and 6 ft. wide.

Fishermen wait for dark, stormy nights to set the nets and periodically empty them in the darkness into concrete storage tanks. Other weirs are made with timber butterfly gates which can be kept open or closed.

There is one avenue of escape for the fish: all weirs must be so built that a tenth of the deepest part of the river is left free. This "Queen's Gap" is left open so that enough eels can reach the breeding grounds to perpetuate the species.

The Sway of the Waters

In this article "Peko" discusses and examines some of the studies that have been and are being carried out to explain the movement of the North Sea herring.

Most changes in the sea and fisheries are slow; and a human life too brief properly to measure them. The difference one man sees, though real enough to him, is not easily passed on to others. But modern research and economics seem to focus things more sharply; and in the North Sea, at any rate, we can see the changes taking place, and speculate about them as they happen. And although it is unwise to jump to conclusions, the natural post-war trends point to a shift in the fortunes of our herring fishery, as well as a continuing change in method of working.

Nearly all fisheries are controlled by the great ocean currents. With these the sea is a world temperature regulator, absorbing the sun's tropical heat and carrying it in water masses that can be traced for year-long journeys out to the fringes of the Poles. The winds help too. The continuous easterly trades drive Equator-warmed water into the great Mexican Bight whence it emerges as the Gulf Stream, a deep, 90-mile wide, 3-knot tide that will take life to northern fisheries maybe 5,000 miles away. The marvel of this great river within the sea is hard to realise. After moving north and then east over the Newfoundland banks it becomes the slow, wider North Atlantic Drift helped by the prevailing westerlies of this area. With offshoots branching towards Greenland, Iceland and Norway, as well as south to Spain, this stream tempers the climate of N.W. Europe. In the southern hemisphere similar great currents occur; circulating just like a domestic boiler system, the warm water going outwards at the top, and the cold polar streams returning deep over the ocean floors.

Arctic Change

The most notable fishery change of recent times is due to the pronounced warming of the Arctic

waters. Whether this continuing change is due to a lessening of the cold Polar currents or an increase in the "Drift", the result has been expanding fishing production in the northern seas. In east Greenland the cod was unknown before this century; now it is a basic product. On the west coast the fishery has moved 250 miles northward and increased by thirty times. This same warming - or lessening of cold rather, has allowed our trawlers to penetrate further north, to work in winter where formerly they hardly reached in summer.

Our scientists have shown that cod at any rate are ruled by small temperature changes, have even located the shoals by means of a certain temperature line. Herring may be different though. Their daily up and down movements through perhaps 70 or 80 fathoms of water suggest they are not worried by a few degrees of temperature change; although some German workers have advanced this as a cause of low swimming in late summer. Other factors like plankton content, or the colour of water may have more influence on these pelagic fish (colour here means the so far unexplained constituents that cause the varying blues and greens of North Sea water).

Lost Fisheries

The failure after the 15th century of the important Hanseatic herring fishery has been explained by some Swedish scientists as due to a change in the great water movements. Apparently the Middle Ages was a time of exceptional tides. And when they diminished, and the cold saline water of the deeps no longer spilled over the continental shelf into the Baltic the herring came no more. A repetition of that favourable state of earth, sun and moon and stars will not come for several centuries; but there are other shorter rhythms which suggest that a revival of Sweden's herring fishery is approaching.

Compared with these events, the fluctuations in our own herring fisheries are small though of local importance. But little straws show the wind. And a knowledge of their causes may help in solving the bigger problem.

According to F.S. Russell, an expert on plankton, the failure of the Plymouth fishing for

winter spawners coincided with the disappearance of a certain type of Atlantic water from the area. Not only are there no herring, but the present "Channel" water is poor in phosphates and plankton. This could be a first-class example of cause and effect in the sea fisheries.

The Firth of Forth winter spawning is another fishery that has disappeared without trace. Other deserted breeding grounds are Dimlington off the Yorkshire coast and the Cromer Knoll, as well as the Dowsing area. Between these are the Whitby ground, still productive but with the herring tending to swim low, the Longstone, and Craster Smooth. The latter grounds, after an eclipse, seem to be recovering somewhat.

But far more disturbing in the last few years is the failure of the Shetland grounds, once the most prolific of our herring fisheries. Not only are the shoals leaving these grounds earlier each year, but the high production has shifted to the ports of Fraserburgh and Peterhead and Aberdeen. And in their abnormally heavy catches in '52, '53, and '54 the best fishing area has moved steadily to the southward. Something seems to be sweeping the Scottish herring further south each year and at the same time causing heavier catches; which is just what one would expect from the intrusion from the north of a large body of water that the herring could not tolerate.

Mystery of Migration

Now it must be easier to get lost in the sea than on land. Just to know you have travelled in the well-known circle needs a mark of some kind. But in the sea there are no footprints even. It is difficult enough on the surface where the experienced mariner has uncanny ways of finding himself without lightship or land; but underneath, especially in the deeps, the lebensraum is up and down as well as to and fro, a three-dimensional desert. How do the sea travellers find the way in their frequently extensive migrations?

In the case of North Sea herring we know of hundred-mile journeys in a few days. But we have no idea of how much such journeys are guided by spawning instinct, and how much by the push of suitable water.

It is unlikely that the move of 160 miles in a fortnight by a marked channel spawner from East Anglia was accompanied by water movement; though it would have been possible in the southward rush of the gale driven floods in January 1953. An instinctive southerly march is fairly well shown in these herring. The swim is always from the north, whatever the weather. But it is clear too that this march is hastened or delayed, or biased to east or west by wind conditions, though the mechanics of it are not known. In fact we have here the same mystery of orientation as in most of the bird migrations, as well as insects and mammals. How they navigate we just do not know.

Two main factors, however, we can assume; first the inward migrational urge or instinct, whether for spawning or feeding; and second the outside or environmental influence which is always acting upon it. And in this changing situation of the Scottish herring (that is unprecedented and nothing to do with normal migration) there may be a better chance to connect it with water movements, and perhaps explain one phase of outside influence.

Plankton Water Labels

In the study of sea creatures in relation to their surroundings - called ecology for short, the sea detectives are steadily perfecting a new tool, or method of water identification. If there are no sea footprints, it seems now that most of the different currents and water masses can be fingerprinted by the plankton belonging to them. This is no new stunt or labour-saving dodge. It is an exact science. It requires complete knowledge of the life history of the animals concerned. For these "indicator" species can only truly denote one kind of water if they are unable to live and breed in any other.

The plankton pointers are of many types, from coastal forms with a bottom living stage to oceanic creatures that winter in the 1,000 fathom deeps. They are alike only in being indigenous to some special water.

Sagitta, the arrow worm, can nearly always be seen when a plankton haul is washed into a glass jar. Its various forms are like $\frac{3}{4}$ in. glass rods with

grappling iron jaws that prey upon the smaller plankton animals, including young herring. *Sagitta setosa* is a species belonging to coastal waters of the North Sea. *S. elegans* is larger and usually found in Atlantic water; and the two species are a useful guide to water movements in the North Sea and the Channel. Most of the arrow worms are transparent, the largest 4 in. long, but occasional bright red specimens have been taken from 1,000 fathom in the Atlantic.

The three main water systems of our near grounds are :

1. The various coastal waters, generally of low salinity and poor in plankton.
2. Atlantic water, saltier with more phosphates and richer in plankton.
3. Arctic water, cooler and sometimes deeper, and rich in plankton, especially *Calanus* forms.

Each of them has its own typical plankton community, tied to it as firmly as the larks and pipits are to one kind of nesting place, the finches to another, and the swallows to yet another. A tow net haul or two in any given area will now tell the plankton specialists as much about the water as hydrographical sampling for salinity and temperature etc., especially as certain species are indicators of the mixture of different waters.

The continuous plankton records started many years ago by Professor A.C. Hardy have now been extended to some ten steamer routes across the fishing grounds. This grand scale research has not yet proved of much commercial value, apart from helping in the forecasts of the complicated summer fishery.

It is slow work, like long term weather forecasting, this cataloguing of the plankton population from season to season. It needs the painful study of a vast amount of material, for working in formalin is worse than peeling onions. The plankton is cleverly preserved on rolls of gauze, every few inches of which represents a mile of sea, sampled at a depth of 5 fathoms; each roll a test book page for

future students. Results are showing a regular movement of Atlantic water southwards in the North Sea conforming with the normal succession of herring spawning. Now a change is bringing rapid increase in a certain mixed water plankton form that coincides with the displacement of the Scottish shoals.

There are many different forms to study, both plant and animal. Only one tribe, for instance, the valuable Calanoids, has over 30 families each with different species; all with varying life histories and breeding patterns to be studied.

Shrimp Indicators

The Euphausids too are important in the sea food chains. These luminous swimming shrimps range up to 2 in. in length, and have different feeding appendages according to whether they live in deep or shallow water: most surface kinds, like the well-known inch-long krill that feed the southern whales, have fine filtering hairs for browsing the tiny plants; others have their eating apparatus graded and adapted for coarser fare in the drifting animals.

R.S. Glover of Edinburgh, studying Euphausids in the continuous records, separated deep water, shallow, and intermediate forms. He named only eight species. But each had three or four different growth forms (like all crustaceans) in at least one of which identification of species was difficult.

With these and the difficulties of up and down movement - Megalops may swim 300 fathoms deep in daytime, and between surface and 200 fathoms at night - we can see why he does not claim them as indicator species. He does suggest though that they denote respectively oceanic and coastal conditions, and that one of them may indicate cascade water. This last is winter cooled water that has poured down the continental shelf taking shallow water plankton into the deeps. It is all quite complicated really. But this is one type of water movement that scientists have discovered by finding plankton indicators in the wrong place so to speak.

New Evidence

So far as the present herring problem goes, however, the main plankton connection is showing in a tiny swimming snail, or mollusc called *Clione limacina*. It is one of the Pteropods or sea butterflies, in which the foot part of the snail is modified to a pair of wings for swimming. Compared with the important Euphausiids and Copepods, it is one of the lesser lights; but since 1951 it has been increasing rapidly in the samples from the herring grounds, and in the herring stomachs too. And it seems this new abundance of *Clione*, or the mixed coastal and northern water it indicates, coming earlier each year, is the reason for the southward move of the herring.

Although not acquainted with this one, I remember that A.C. Hardy considered another Pteropod as unfavourable for herring. This was *Limacina retro-versa*. It caused the black discs which Hardy advised users of his plankton indicator to avoid; and may also have been something to do with the black gut in Shetland herring. We found it occasionally, never black, but as a fine dark peppering among the other organisms.

But the influence, if any, of this *Clione* is not detrimental to fishing. Although it is doubling yearly, the herring now swim as thick off Aberdeen as ever they did off Lerwick. And providing they do not desert their normal spawning grounds, maybe no harm will be done - except to the internal economy of the Shetlands. But other grounds and other fishings have failed; and the sooner we find the reason for what is happening in the North Sea the better, even though we cannot do anything to prevent it.

From experiments made at Plymouth recently it seems unlikely that the plankton animals alone would be to blame, but rather some unknown quality in the water itself. Apparently there is more in sea water still than meets the eye, even under the microscope. For D.P. Wilson found that the Atlantic water (indicated by *S. elegans*) was far better for the survival of young sea urchins and marine worms than was the present Plymouth water. The subjects were treated exactly alike, except for the difference in water; and time after time they were more prone to thrive in the

Elegans water, and more prone to die in the Setosa water.

In a mixture of the two waters the larvae thrived too; so the experiment showed that the Plymouth water now lacks something essential for survival. No wonder the herring stopped coming.

The new problem of this move of the summer herring comes upon others, also unexplained. Since the war the East Anglian herring have got bigger. The age group composition is changing too, with the older classes getting less and less. The suggested explanation is that these are man-made changes; that by new fisheries the southern herring are being attacked more heavily in their youngest and oldest stages.

Thus, with these as well as natural changes, affecting different races, the spring and autumn spawners of Scotland and winter spawners of the Channel, an overall picture of the North Sea herring is difficult, if not impossible to get. We can however, note in more detail the changes in distribution that have occurred since 1939.

Meanwhile, if the southerly swing continues, there is no reason why the herring shoals should not move as far from the Buchan ports as they have already done from Lerwick. If that happens, the curing section that remains may have to move with the herring. In its present state with women as hard to get as fishermen, an attempted move to the now disused ports between Aberdeen and Shields might well finish off curing altogether; but once equipped with gutting machines work should be possible wherever the herring are landed.

("World Fishing"

London

August, 1955)

The Waters are Not Divided

With the First World Conference on Fisheries held in Rome recently, we have taken a major step toward recognition of the true character of the fisheries. Ours is a calling which, like it or not, is international. It was international long before the advance of

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civilisation had made fish and seafoods important products in world trade. The very medium in which fish swim is a world traveler. Carried by the great currents of the oceans which cover 71% of our planet, the particules of water dripping from your trawl doors were a few weeks ago clinging to the hull of a ship off the coast of Scandinavia or in the China Sea.

Fish themselves are migratory; they know no sovereignty, spawning in one place and moving during their life cycle through waters under the jurisdiction of many nations. It is this movement, and the vast areas over which it takes place, that has defeated the efforts of marine biologists to understand fully the reasons for the rise and fall of fish populations. Moreover, no fish species is self-sufficient; there is an intricate relationship between any species and the fish it feeds on, and in turn, the food its food feeds on, down through a long train of marine organisms back to a prime source in the most primitive micro-organisms to which we can ascribe life. Therefore, what happens in unknown waters on the other side of the globe may have a drastic effect on American fisheries.

Understanding of our marine resources and plans for their conservation simply cannot be undertaken effectively on a merely local, or national basis. Even had we this understanding, regulations to benefit from it could not be other than international. The great principle of freedom of the seas outside a three-mile territorial waters limit has long meant that what we regard as part of our natural resources will be fished by foreign ships using their own special methods and gear. It would be of small protection to regulate our fishermen when working alongside them, were crews not bound by the same laws.

Technical knowledge, too, is international. The free exchange of research information has always been one of the vital needs of science. Even in the jealous world of industrial research licensing agreements between American corporations and foreign affiliates have made the work of the best brains in one country available to those who can use them in another. Duplication of research is avoided. We dare say there are members of our industry working on problems in all stages of fish production who are duplicating efforts being made elsewhere - some of them, perhaps, attacking

problems for which a solution has been found.

The greatest accomplishment of the First World Conference on Fishing was in this area. Some of the representatives may have come to renew old quarrels over fishing rights, but they remained to recognise the existence of problems common to their neighbours.

The great need for scientific research was apparent to all, and as the Conference proceeded under the able and tactful guidance of Norway's Klaus Sunnanaa, the delegates found themselves with more to agree about than to fight about.

For example, conservation is a sore issue among countries lying along the shores of the world. Everyone knows the necessity of conservation and everyone feels his next door neighbour ought to do it. On the issue of conservation alone the Conference might have become a dog fight (rumours say it almost did) but the essential unity of fishermen the world over prevailed.

Before any serious battle was joined such nations as the United States, Canada, Newfoundland and France reminded the delegates that they had entered into agreement as long ago as 1920 in order to co-ordinate their scientific research in the Northwest Atlantic. This North American Council provided a background for the subsequent establishment of the International Convention for the Northwest Atlantic Fisheries.

No one claimed that this agreement had worked out perfectly or that it is now working to every member's full satisfaction; but it does work and it does exist. Such fisheries as those in the South-Eastern Pacific or the flounder, salmon and cod fisheries in the Baltic have no agreements operating whatever. Delegates from Baltic nations, therefore, had the opportunity to learn that conservation and research are not dreams; they are actualities in some parts of the world. By the next World Conference, the Baltic countries may be able to come forward with some plan that will preserve this vital source of food for their people.

With the help of the more experienced members of the Conference, they may be helped to iron out difficulties and achieve for themselves the benefits of conservation now enjoyed by other nations.

In general, all proposals for the future were based upon working agreements of the past. Some of these agreements, like the acorn from which the mighty oak grows, are rather small but they represent a beginning. The North Pacific Fisheries Convention provides that in the event a committee appointed to reach a conclusion fails to do so within a reasonable length of time, the problem shall be referred to another committee of competent and impartial scientists and this second committee's decision shall be binding upon both parties. Thus, deadlocks are avoided. The experience of the North Pacific Fisheries Convention became the property of the entire World Fisheries Conference.

Another contribution was made by the North Pacific Halibut Convention which provides that authorised officers of any Contracting Party may enforce on the high seas the regulations promulgated by the Commission ... such nationals then being dealt with in their own country. In other words, illegal fishermen are subject to arrest by anyone who catches them and subject to punishment within their own country. This may sound like an invitation to open warfare on the high seas, but it represents an attempt to solve the problem of enforcement while respecting the rights of nationals from each country engaged in the Convention.

By the end of the Conference the delegates had succeeded in coming to the following conclusions (here summarised):

1. International co-operation in research is essential and the Conference went on record as favouring any Conventions negotiated for this purpose.
2. Present international fishery regulations being based generally on the geographical and biological distribution of marine populations and the Conference agreed that this method of arriving at Conventions was most practical.

3. The term "Convention" was carefully defined so that in the future all nations wishing to enter into a Convention will have guidance as to what type of agreement is most likely to prove successful.

4. The Conference specifically opposed any attempt to interfere with the internal regulations of any state in regard to its own nationals.

5. Various measures for ironing out future disagreements are suggested, such as arbitration, self-regulation, co-operation, etc.

6. The Conference frankly recognised the difficulty of recommendations in cases where over-fishing has already occurred by the intensive exploitation of offshore waters adjoining heavily fished inshore waters. Opinion was evenly divided as to the responsibility of coastal states in such a situation.

7. The Conference also refused to attempt to set a definite limit to territorial waters. This was, after all, the First World Fisheries Conference; this question may have to await the Hundredth Conference for a solution.

8. The Conference agreed that discussions and explanations of treaties or other formal Acts at the Conference were not to be considered as legal interpretations of such treaties. Perhaps the delegates were agreeing altogether too well and didn't want the home folks to think they had signed their lives away!

There is no substance so common to all of the world as the seas our fishermen harvest. Conditions and problems are more uniform than those of agriculture, husbandry, mining, manufacturing or any of the other occupations which have so benefited from either governmental or private exchange of knowledge - yet it is the fisheries - most desperately in need of such co-operation - which have had least of it.

Ten years ago our country could not have participated adequately in a world fisheries conference; there would have been no one to speak for us. The formation of a National Fisheries Institute was a necessary first step toward national maturity that has

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prepared us for an organised advance into our future on the global level which is the true scale of the fisheries.

("Fishing Gazette" New York May, 1955.)

"Fish Houses" in Japan to Help Restore Inland Fishing

Described by Americans as "Fish Apartment Houses", the Japanese are trying "fish shelters" to improve inland sea fishing, according to a U.S. Consular dispatch from Kobe. Hollow concrete blocks are lowered to the bottom of Japan's inland sea in a move to increase the fish population and thus help commercial fishing, it says.

The inland sea fishing grounds are an important source of food for southern Japan, but have never fully recovered from the serious depletion caused by intensive wartime fishing. The concrete forms will serve to obstruct and hinder the currents along the bottom and thus afford shelter for bottom fish and a breeding ground for plankton and other marine life on which fish feed.

The blocks, 4x4x5½ft. have windowlike openings on all sides and top, and are sunk in 16 groups of 80 units each, making a total of 1,280 blocks. Total cost is estimated at about £10,000.

("The Fishing News" London August 19, 1955.)

Rare Fish Caught in N.Z.

A big specimen of one of New Zealand's rarest fish, a 4 ft. 6 in. Rivettus, or "oil fish", has been caught in Cook Strait. It is believed to be only the fourth of its kind caught in the world. Instead of lying flat as do other fish, each separate scale stands out from the skin as a high inch-long razor-sharp, four-edged spike.

("Australian Outdoors" Sydney August, 1955.)