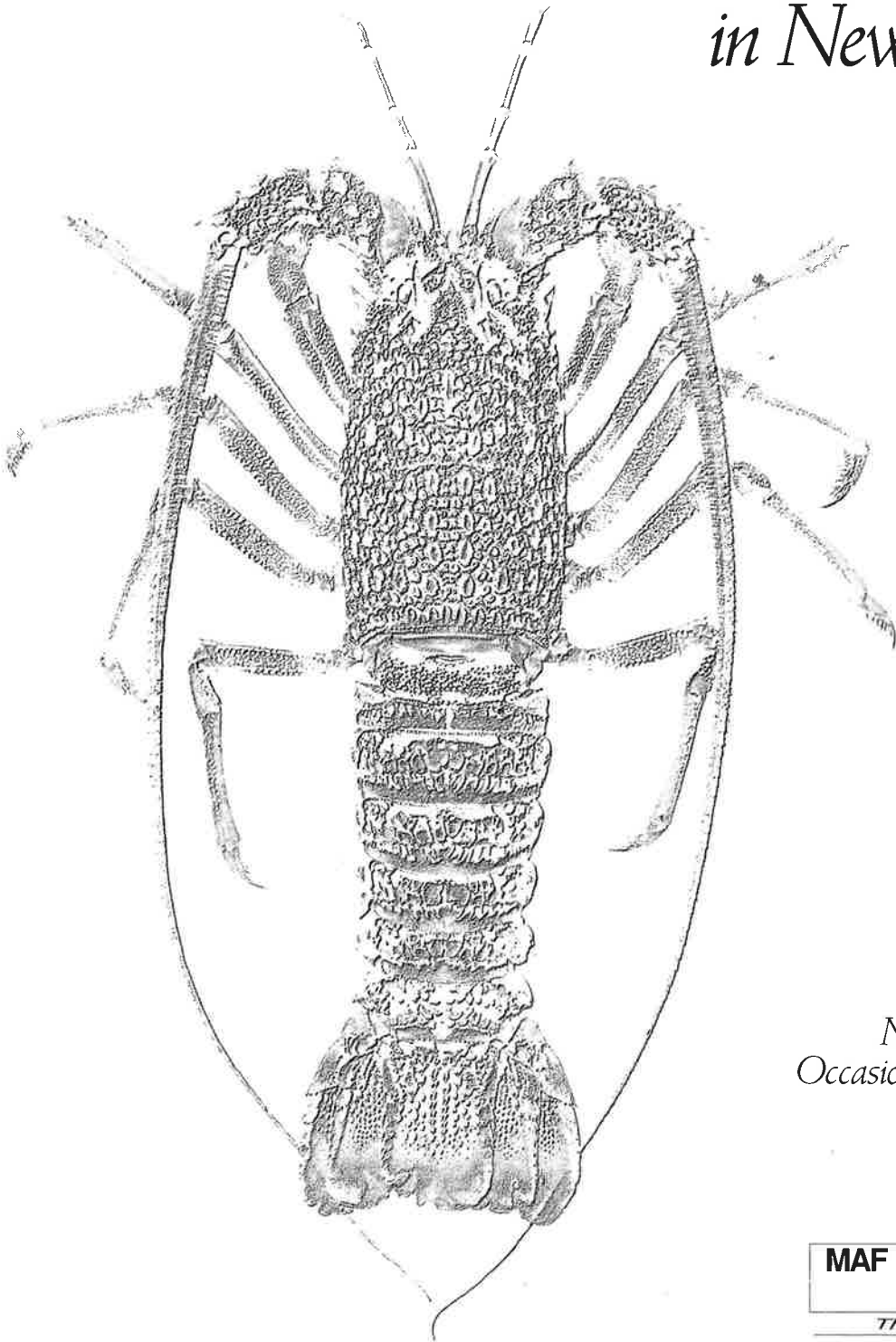


*An annotated bibliography  
of the red rock lobster  
Jasus edwardsii  
in New Zealand*



*Paul A. Breen  
and  
John L. McKoy*

*New Zealand Fisheries  
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**MAF Fish**

*The Leading Edge* /

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Cover photograph by Alan Blacklock

## INTRODUCTION

This bibliography brings together literature on the red rock lobster, *Jasus edwardsii* (Hutton); it includes and extends the earlier bibliography of McKoy (1979; No. 216), and has a subject and geographical index.

There are three species of palinurid crustaceans (spiny lobsters; Sims 1965) in New Zealand. The smaller literature on the green or packhorse lobster, *J. verreauxi*, was summarised by Kensler (1967) and Booth (1988; No. 123). The third species, *Projasus parkeri* (Booth 1984), is known from only a few deep-water specimens.

The bibliography is aimed at several groups of users. Researchers, both basic and applied, are one obvious group. The second group comprises segments of the fishing industry - *J. edwardsii* supports the second most valuable export fishery in New Zealand. In this group might be found interested rock lobster fishers and processors as well as fishery biologists and managers. In considering possible fishery management options, all segments of this group should know what was proposed or implemented in the past, what the reactions were, and what impact was observed on the fishery and the resource. It is especially hoped that this bibliography will find use in this way. A third group contains those to whom rock lobsters are of indirect interest, e.g., economists, historians, anthropologists.

The bibliography is reasonably complete to the end of May 1988. General as well as scientific articles are included, and we include many articles from New Zealand fishery trade journals such as *Catch*, *Commercial Fishing*, and *N.Z. Professional Fisherman*.

Other names for *J. edwardsii* include "spiny lobster" in recent legislation, the Maori name *koura*, and the very common but incorrect "crayfish". In the past, the species has been known by several scientific names, including *Palinurus edwardsii*, *Jasus lalandei*, *J. lalandii*, and *J. lalandei frontalis*. The currently accepted taxonomic determination is that of Holthius (1963; No. 179). The very similar *J. novaehollandiae* may eventually be formally considered the same species, as it is now informally by some workers, but only studies describing New Zealand *J. edwardsii* are included.

Information about the fishery is also found in the Annual Report on Fisheries, published by the New Zealand Ministry of Agriculture and Fisheries, and in the annual reports of the New Zealand Fishing Industry Board. Brief descriptions of the scientific programmes appear in the Fisheries Research Centre Annual Report (before 1988 in the Fisheries Research Division Annual Report).

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BOOTH, J.D. 1984: New rock lobster species discovered.

*Catch* 11(6): 21.

KENSLER, C.B. 1967: An annotated bibliography of the marine spiny lobster *Jasus verreauxi* (H. Milne Edwards) (Crustacea, Decapoda, Palinuridae). *Transactions of the Royal Society of N.Z.*, *Zoology*, 8: 207-210.

SIMS, H.W. 1965: Let's call the spiny lobster "spiny lobster". *Crustaceana* 8(1): 109-110.

## BIBLIOGRAPHY

- 1 AKROYD, J., and BOOTH, J.D. 1984: Rock lobster fishery under discussion. *Catch* 11(5): 7.  
A workshop examined South Island landings, puerulus stage settlement rates, juvenile abundance, and fishery economics. Although trends were a cause for concern, there was no evidence of a biological problem.
- 2 AIKEN, D.E., and WADDY, S.L. 1980: Reproductive biology. In J.S. Cobb and B.F. Phillips (Eds.), "The Biology and Management of Lobsters. Vol. I, Physiology and Behaviour", pp. 215-276. Academic Press, New York.  
A comprehensive review of lobster reproductive biology. *J. edwardsii* is discussed (p. 237) in the context of variation in size at onset of sexual maturity. Street (1969; No. 283) suggested that *J. edwardsii* matures earlier in warmer waters; the review suggests that this pattern does not hold for other species.
- 3 ALLAN, R.D. 1979: Structure, function and light induced damage in the compound eyes of New Zealand rock lobster *Jasus edwardsii*. Unpublished MSc thesis, University of Waikato, Hamilton. 151 p.  
This thesis describes structure of the eye, screening pigments, and the processes of light and dark adaptation. The behavioural, structural, physiological, and probable ecological effects of exposure to direct sunlight are then described. Lobsters avoided bright light, and tried to cover their eyes when exposed to it. Prolonged exposure to bright light caused serious damage.
- 4 ANDERTON, T. 1907: Observations on New Zealand fishes, etc., made at the Portobello Marine Fish-hatchery. *Transactions and Proceedings of the N.Z. Institute* 39: 477-496.  
Female *J. edwardsii* carrying eggs were observed in the laboratory, and some of the eggs were hatched out in experimental jars. This note describes female behaviour, fecundity, and larval behaviour. (The note goes on to describe an attempted introduction of *Homarus gammarus* to New Zealand). See No. 295 for description of larvae obtained in this study.
- 5 ANDREW, N.L. 1984: A short term study of the interactions between sea urchins and rock lobsters. Report to Fisheries Management Division, N.Z. Ministry of Agriculture and Fisheries. 38 p. (Unpublished report, held in Fisheries Research Centre library, Wellington.)  
Sea urchins (*Evechinus chloroticus*) are eaten by *J. edwardsii*. Microhabitats and distribution patterns of each species within the Marine Reserve at Leigh are described. Feeding studies showed that medium sized lobsters could eat all sizes of sea urchin. However, they also suggested that sea urchins are not a preferred prey. The author cautiously suggests that lobsters do not strongly influence the dispersion, behaviour, or abundance of sea urchins.
- 6 ANDREWS, S.P. 1984: Gisborne rock lobster fishery economic appraisal 1981-1983. *N.Z. Fishing Industry Board Report EM 51*. 23 p.  
This report addresses the issue of long-term economic viability of the Gisborne rock lobster fishery. It describes the fishery structure in detail, then provides a financial analysis which concludes that \$62 000 gross landed value is the breakeven point for an average vessel. The study recommends that the number of vessels in the Gisborne Controlled Fishery area at that time (1985) not be increased, and that it be reduced if catches proved non-sustainable.

- 7 ANNALA, J.H. 1976: Carapace length for rock lobsters - not yet. *Catch* 3(7): 8.  
Morphometric studies were made to find the equivalent carapace length for a 152 mm tail, so that a carapace length size limit could be introduced. However, because males and females have different sized carapaces for the same sized tail, and because lobsters vary in shape among areas, more work was considered necessary. The author discusses the difficulties of instituting carapace length as the legal measure if tail length is retained as a back-up measure, because of the variability of the relationship between the two.
- 8 ANNALA, J.H. 1977: Effects of increases in the minimum legal size on the Otago rock lobster fishery. *Fisheries Research Division Occasional Publication No. 13*. 16 p.  
The history of size limit changes in the Otago area is considered, then Hancock's method is used to 'predict' the effects of past size limit changes. To do this an overall estimate of instantaneous fishing mortality rate  $F = 1.06$  is obtained from tag return data (see No. 283). Agreement between predictions and observations was not good, suggesting that equilibrium had not been reached and that recruitment fluctuations interfered with expectations. The author recommends that the size limit be increased further to increase long-term yields, but that this be done by no more than 6 mm at one time, no more often than once every 2 years. Catch composition and fishing mortality rate should be monitored while this is being done.
- 9 ANNALA, J.H. 1979: Mortality estimates for the New Zealand rock lobster, *Jasus edwardsii*. *Fishery Bulletin* 77: 471-480.  
Mortality rates of males caught near Gisborne were estimated from size frequency distributions (SFDs) using three methods, and from tag returns. Estimates from the three SFD methods were consistent, but estimates from tag returns seemed too high. Total instantaneous mortality rate was considered to be  $M = 1.00-1.50$ .
- 10 ANNALA, J.H. 1980: Mortality estimates for the rock lobster, *Jasus edwardsii*, near Gisborne, New Zealand. *N.Z. Journal of Marine and Freshwater Research* 14: 357-371.  
Mortality rates of both males and females were estimated from size frequency distributions (SFDs) and tag returns in the area between East Cape and the Wairoa River, using the same methods as in No. 9. Various methods are compared, and the author concludes that both tag returns and SFDs taken from small areas should be used to estimate sex-specific mortalities. For males, total instantaneous mortality estimates (F) ranged from 0.55 to 2.49; for females from 0.33 to 1.53.
- 11 ANNALA, J.H. 1980: Size at the onset of maturity. *Catch* 7(7): 19.  
This popular article summarises the results presented in No. 33.
- 12 ANNALA, J.H. 1980: Biological area studies: Fiordland. *Catch* 7(7): 27-28.  
Tagging conducted in the fiords, 1979-80, is described, and early growth results are reported.
- 13 ANNALA, J.H. 1980: Offshore potting. *Catch* 7(7): 31.  
A summary of the results presented in No. 24.
- 14 ANNALA, J.H. 1980: Rock lobster landings. *Catch* 7(7): 35.  
Provisional landings and effort data are given for 1979 from each Controlled Fishery area.
- 15 ANNALA, J.H. 1981: Movements of rock lobsters (*Jasus edwardsii*) tagged near Gisborne, New Zealand. *N.Z. Journal of Marine and Freshwater Research* 15: 437-443.  
Of 4600 rock lobsters tagged near Gisborne, 2100 were recaptured and

returned by the fishery. Only 3% had moved more than 5 km, and only those tagged at Mahia East showed directional movement (north). These results suggest differences between rock lobsters in this area and those in the south (cf. Nos. 283, 286).

- 16 ANNALA, J.H. 1983: New Zealand rock lobsters: biology and fishery. *Fisheries Research Division Occasional Publication No. 42*. 36 p.  
A major review of New Zealand rock lobsters including history of the fishery, current fishery, and biology of rock lobsters. Yield estimates are provided and economic analyses described. The current fishery regulations (at 1983) are given, and the process of introducing the Controlled Fishery is described. Appendices give information from N.Z. Fishing Industry Board surveys conducted in 1979, a history of regulations, and policy statements associated with the introduction of the controlled fishery.
- 17 ANNALA, J.H. 1983: The introduction of limited entry. The New Zealand rock lobster fishery. *Marine Policy* 7: 101-108.  
The "Controlled Fishery" for rock lobsters was a management approach in which licences in each of 10 areas were strictly limited. The development and implementation of the Controlled Fishery are described. Objectives for long-term management of the fishery are identified - the most important of these being maintenance of the health of stocks.
- 18 ANNALA, J.H. 1983: [Management discussion paper]. *Catch* 10(5): 21.  
Refers to a discussion paper outlining further options for managing rock lobsters within the Controlled Fishery. These include pot limits and a change to a minimum legal size based on carapace length. The process of consultation with industry is described.
- 19 ANNALA, J.H. 1986: Red rock lobsters. In G.G. Baird and J.L. McKoy (Comps. and Eds.), "Background Papers for the Total Allowable Catch Recommendations for the 1986-1987 Fishing Year", pp. 116-120. (Preliminary discussion paper, held in Fisheries Research Centre library, Wellington.)  
A total allowable catch (TAC) of 4200-4300 tonnes annually is recommended for the North and South Islands combined. Such a TAC would be required to begin management by individual quotas (see Nos. 79, 80, 82). This TAC is based on a surplus production analysis of landings and effort data (see Nos. 30, 171). The paper recommends that cost-benefit analyses be conducted to develop a stock rebuilding strategy.
- 20 ANNALA, J.H., BOOTH, J.D., and MCKOY, J.L. 1977: Catch-effort trends in the N.Z. rock lobster fishery. *Catch* 4(2): 3-5.  
The authors examine catch and catch rate trends, using the number of vessels as effort, and conclude that decreased fishing effort would lead eventually to higher total catches.
- 21 ANNALA, J.H., and BREEN, P.A. 1988: Yield- and egg-per-recruit data inputs and model results for the rock lobster *Jasus edwardsii* from 10 areas around New Zealand. Fisheries Research Centre Internal Report No. 87. 46 p. (Draft report, held in Fisheries Research Centre library, Wellington.)  
Information on size and growth per moult, moult frequency, weight, maturity, and fecundity are summarised for 10 areas around New Zealand. The authors use a modification of Caddy's crustacean model to estimate yield-per-recruit and egg-per-recruit for each area. Overall egg production is estimated at 27% of the virgin population level, assuming constant recruitment.

- 22 ANNALA, J.H., and BYCROFT, B.L. 1982: Fiordland rock lobster study. *Catch 9(7)*: 32.  
Movements of tagged rock lobsters are shown and growth rates discussed.
- 23 ANNALA, J.H., and BYCROFT, B.L. 1983: Fiordland rock lobster study. *Catch 10(11)*: 28.  
An update of No. 22. Movement patterns of tagged rock lobsters are shown and growth rates discussed.
- 24 ANNALA, J.H., and BYCROFT, B.L. 1984: Exploratory fishing for rock lobsters in offshore areas near Gisborne. *Fisheries Research Division Occasional Publication No. 45*. 11 p.  
Research potting was carried out from a research vessel and a chartered commercial vessel offshore from Gisborne. In the best areas examined, catch rates were greater than the average inshore rates, but the authors suggest that the offshore areas would not be economically feasible to fish. Results from tagging were consistent with No. 15, and suggested limited inshore-offshore exchange. Data are given on size frequencies, maturity, and growth increments.
- 25 ANNALA, J.H., and BYCROFT, B.L. 1985: Growth rate of juvenile rock lobsters (*Jasus edwardsii*) at Stewart Island, New Zealand. *N.Z. Journal of Marine and Freshwater Research 19*: 445-455.  
Juvenile growth rates were estimated from mark-recapture studies and analysis of modal size frequency shifts. Growth rates tended to be lower than those observed at Gisborne. They showed significant variation between areas and years. The authors suggest that many factors, including temperature, affect juvenile growth rate.
- 26 ANNALA, J.H., and BYCROFT, B.L. 1987: Fecundity of the New Zealand red rock lobster, *Jasus edwardsii*. *N.Z. Journal of Marine and Freshwater Research 21*: 591-597.  
Relationships between female size and egg numbers, determined with an electric egg counter (Nos. 145, 146), were developed at eight locations. Egg loss during the first half of the ovigerous period was estimated to be 20% at Kaikoura. Comparisons are made with fecundity in other species in the *J. lalandii* group.
- 27 ANNALA, J.H., and BYCROFT, B.L. 1988: Growth of rock lobsters (*Jasus edwardsii*) in Fiordland, New Zealand. *N.Z. Journal of Marine and Freshwater Research 22*: 29-41.  
Growth based on tagging and recapture is described. Growth rate has two components: growth per moult and moult frequency. Growth per moult decreased with size in mature females, but was independent of size in other lobsters. Mature females moulted once per year. In males, the moult frequency decreased with size. The von Bertalanffy model did not describe growth well for females.
- 28 ANNALA, J.H., BYCROFT, B.L., and SMITH, D.W. 1986: Relationships between carapace, first tail segment, and tail lengths for the red rock lobster, *Jasus edwardsii*, around New Zealand. Fisheries Research Division Internal Report No. 47. 17 p. (Draft report, held in Fisheries Research Centre library, Wellington.)  
Morphometric studies were made to support an expected change in size limit from tail length to carapace length. Length of the first tail segment was examined as a "back-up" measure for use after tailing. Measurements corresponding to the present tail length (152 mm) are given. The possibility of a single measurement for both sexes is discussed and the archived original data are described for the use of future workers.



- 29 ANNALA, J.H., and ESTERMAN, D.B. 1985: Estimates of rock lobster yield. *Catch 12(2)*: 27-28.  
Yields predicted from surplus production modelling and time series analysis (No. 30) are presented in a popular article, and the associated assumptions are discussed.
- 30 ANNALA, J.H., and ESTERMAN, D.B. 1986: Yield estimates for the New Zealand rock lobster fishery. In G.S. Jamieson and N. Bourne (Eds.), "North Pacific Workshop on Stock Assessment and Management of Invertebrates", pp. 347-358. *Canadian Special Publication of Fisheries and Aquatic Sciences 92*.  
Catch and effort data for the North and South Islands combined, and for each of the 10 Controlled Fishery areas, are presented and discussed. An estimate of maximum sustainable yield of 4700 tonnes for North and South Islands combined is obtained from Fox's surplus-production method. Estimates of current catch were made. Under the assumption that effort was stable, these were used to provide long-term yield estimates for each Controlled Fishery area.
- 31 ANNALA, J.H., and KING, M.R. 1983: The 1963-73 New Zealand rock lobster landings by statistical area. *Fisheries Research Division Occasional Publication: Data Series No. 11*. 20 p.  
Landings and efforts from return forms submitted by commercial fishermen are presented for each of 24 statistical areas. Landings for *J. verreauxi* in 5 areas from 1967 to 1973 are given. Because total landings (both species) were compiled in two ways (by statistical area and by port of landing), these figures are compared for 1963 to 1973, and good agreement is found for most years.
- 32 ANNALA, J.H., MCKOY, J.L., and BOOTH, J.D. 1980: Biological area studies: Gisborne. *Catch 7(7)*: 26.  
Growth, mortality, and movements are briefly described. Seasonal variation in the abundance and catch composition of juveniles is discussed.
- 33 ANNALA, J.H., MCKOY, J.L., BOOTH, J.D., and PIKE, R.B. 1980: Size at the onset of sexual maturity in female *Jasus edwardsii* (Decapoda: Palinuridae) in New Zealand. *N.Z. Journal of Marine and Freshwater Research 14*: 217-227.  
The size at which 50% of females were mature, as defined by the presence of eggs or well-developed setae on the egg-bearing pleopods, was determined from observations made in 27 areas. The authors used the technique of plotting ogives on probability paper. Considerable variation was found among areas, but not among years within the same area. Much of this variation could be explained by variation in water temperature (cf. No. 2). Implications for management of the fishery are discussed. The authors argue that because declines in catch rate have been similar throughout the country, no declines in recruitment have been caused by having minimum sizes less than size at 50% maturity in some areas.
- 34 ANNALA, J.H., MCKOY, J.L., and ESTERMAN, D.B. 1982: Rock lobster studies at Gisborne. *Catch 9(10)*: 15-16.  
A popular article summarising the results presented in Nos. 10 and 15.
- 35 ANNALA, J.H., and SANDERS, B.M. 1981: The 1979 New Zealand rock lobster landings. *Fisheries Research Division Occasional Publication: Data Series No. 1*. 28 p.  
Reported landings and efforts (vessel-days and pot-lifts) from fishing return forms are given for each of 42 statistical areas (not the same areas as in No. 31) and each of the 10 Controlled Fishery areas for 1979.

- 36 ANNALA, J.H., and SANDERS, B.M. 1984: Record 1983 lobster landings. *Catch 11(7)*: 22-23.  
A popular article summarising data from No. 258.
- 37 ANNALA, J.H., and SANDERS, B.M. 1985: Rock lobster landings increase again. *Catch 12(11)*: 12-12.  
A popular article summarising data from No. 259.
- 38 ANON. 1963: Ending tailing at sea will end Southland crayfishing says fishermen's president. *Commercial Fishing 2(2)*: 8.  
Although this article deals with a controversy over the permissibility of tailing at sea in the Chatham Islands fishery, it also provides insight to several other issues and problems in the Chatham Islands fishery of the period.
- 39 ANON. 1966: Crayfish tailing at sea will continue in Southland and Westland. *Commercial Fishing 5(7)*: 20.  
The N.Z. Fishing Industry Board supported continuation of tailing at sea in areas remote from processing plants. It also recommended research into escape gaps, a closed season to protect breeders, prohibition of spearing or skin diving for rock lobsters, investigation into the Chatham Islands fishery, research into handling and packaging, and a requirement for the industry to supply local markets adequately.
- 40 ANON. 1966: Big crayfish caught off Chathams. *Commercial Fishing 5(8)*: 10.  
One fisherman's impression of the early stages of the Chatham Islands lobster fishery.
- 41 ANON. 1966: Chathams crayfishing still under fire. *Commercial Fishing 5(9)*: 9.  
Some aspects of the early Chatham Islands fishery are described. Regulations banning tailing at sea are seen as a major handicap to development of the fishery. Conservation is thought not to be a problem, as removal of the larger individuals (a 32 ounce (910 g) tail is described) will make room for more smaller ones. Problems caused to the islanders include deterioration of roads and a shortage of labour at shearing time.
- 42 ANON. 1968: Conference on crayfishing says trawling should be banned. *Commercial Fishing 7(4)*: 30.  
Based on a report from the N.Z. Fishing Industry Board, the Marine Department proposed a number of regulation changes, including prohibition of trawling at the Chatham Islands, inclusion of escape gaps in lobster pots, and proper marking of pots.
- 43 ANON. 1968: Limit for amateur crayfishers. *Commercial Fishing 7(10)*: 19.  
The N.Z. Fishing Industry Board expressed concern to the Minister of Marine about amateurs selling their catches, and recommended that a limit of 6 lobsters per person per day be imposed. At this time the limit was 12 per person, 30 for a party.
- 44 ANON. 1969: Chathams fishing is "wild and unrestrained" says Mr. Kirk in heavy attack on Govt. *Commercial Fishing 8(8)*: 13.  
Written at the peak of the Chatham Islands fishery, when 230 vessels were reported to be fishing lobsters there, this article describes some of the problems being caused and conveys the impression of a gold-rush taking place.
- 45 ANON. 1969: Report of the Fisheries Committee to the National Development Conference. Wellington, New Zealand. 107 p.  
At this time, rock lobsters were New Zealand's most valuable fishery. Various recommendations are made respecting the fisheries as a whole and rock lobsters in particular. Sustainable yield of rock lobsters was estimated to be 7200 tonnes annually, comprising 4500-5000 tonnes from the North and South Islands and the rest from the Chatham Islands.

- 46 ANON. 1970: Rock lobster regulations seen as threat to some livelihoods. *Commercial Fishing* 9(3): 13.  
Negative reaction to change from a 10-inch (254 mm) total length size limit to a 6-inch (152 mm) tail length size limit is described in this popular article.
- 47 ANON. 1970: "No-tailing-at-sea" furore. *Commercial Fishing* 9(10): 11.  
Suggestions by the Marine Department that the Southland and Westland tailing-at-sea area be abolished met strong opposition from industry. See also page 13 in the same issue.
- 48 ANON. 1971: Do frozen rock lobster tails shrink? *Commercial Fishing* 10(6): 15.  
The effects of tailing, chilling, and freezing on tail length were examined as significant effects would have implications for enforcement of the size limit. Few tails shrank, and all operations caused increases in the mean length. Most of the change appeared to result from tailing.
- 49 ANON. 1971: Feelings ran high over rock lobster tailing-at-sea issue. *Commercial Fishing* 10(7): 6-7.  
This article, describing reaction to a Parliamentary Select Committee's recommendations on the tailing-at-sea and Karitane concession areas, illustrates the continuing depth of feeling on these issues.
- 50 ANON. 1972: Size limit has lobster fishermen fearful of future. *Commercial Fishing* 11(10): 4-5.  
In 1972 the size limit was increased by half an inch (12.7 mm) (tail length) in the Otago concession. This article describes fishermen's reaction to that change and their fears that the Otago fishery would disappear if any further increase took place (cf. No. 8).
- 51 ANON. 1973: Decline in wet fish, rock lobster landings. *Commercial Fishing* 12(10): 17.  
The N.Z. Fishing Industry Board noted steadily increasing numbers of rock lobster permits while catches remained the same or decreased, leading to financial hardship.
- 52 ANON. 1974: Unique cray sighting. *Dive (N.Z.)* 13(3): 30-31.  
A diver reports observing several circles (illustrated) of berried females in deep water off Napier. It is suggested that release of larvae may have been taking place (see Nos. 208, 223).
- 53 ANON. 1976: Rock lobster conference. *Catch* 3(6): 32.  
MAF staff considered that further increases in the Otago size limit should be postponed, commercial diving for lobsters banned, and escape gaps placed in traps anywhere except on the floor.
- 54 ANON. 1976: Rock lobster research aims at improving fishery. *Catch* 3(6): 3-5.  
A brief summary of research on rock lobsters and rock lobster fisheries being carried out by the Fisheries Research Division, Ministry of Agriculture and Fisheries.
- 55 ANON. 1976: Rock lobster measurements now metric. *Catch* 3(8): 9.  
The legal sizes for red and packhorse lobsters were changed from 6.0 and 8.5 inches to 152 and 216 mm respectively. Problems with the Government measuring gauge are described.
- 56 ANON. 1978: NZ rock lobsters' long growing-up process makes a delightful tale. *Catch* 5(7): 22-25.  
A summary of rock lobster biology. Topics include anatomy, food, life cycle, growth, reproduction, movements, and predators. A large diagram shows stages in the life cycle.
- 57 ANON. 1978: Model shows way to balance fishery. *Catch* 5(7): 28.  
A popular interpretation of the modelling results presented in No. 254.

- A stock production model for the combined North and South Island rock lobster fisheries is presented; the number of registered boats is used as the unit of effort. Management options based on this model are discussed.
- 58 ANON. 1978: Big hands work magic on small tails. *Catch 5(7)*: 28.  
This article describes a Fishery Officer's interpretation of the tail length regulation allowing "no more pressure..." than is necessary in measuring a tail. The article exemplifies the problems with tail length as a legal size measure.
- 59 ANON. 1978: Otago size stays while fishery is under review. *Catch 5(7)*: 30.  
Changes in the Otago size limit and their effect are reviewed (see No. 8). Further increases in the size limit were shelved (and have remained there).
- 60 ANON. 1978: Ghost fishing under study. *Catch 5(8)*: 3.  
Ghost fishing occurs when lost fishing gear - monofilament gill nets in this instance - continue to catch and kill fish. This article describes how rock lobsters are attracted to fish caught in lost nets and become entangled themselves. Regulations to control careless part-time use of gill nets are proposed.
- 61 ANON. 1978: Rock lobster talks underway. *Catch 5(9)*: 12.  
This article describes the planning and consultation process for the introduction of the Controlled Fishery for rock lobsters. Various opinions are reported on related issues, such as the need for protective measures and pot limits.
- 62 ANON. 1980: The handling, storage and transport of live rock lobster. New Zealand Fishing Industry Board, Wellington. 11 p. (Unpublished report, held in Fisheries Research Centre library, Wellington.)  
This is essentially a manual of methods recommended for use when rock lobsters are to be shipped to the live market abroad. Several live storage systems are illustrated, and details of oxygen, salinity, and temperature are discussed. Legal requirements are outlined. This manual is based on information developed in Ireland and the UK.
- 63 ANON. 1980: Southern rock lobster study underway. *Catch 7(1)*: 9.  
Tagging and catch sampling in the Southern and Otago areas are described. The large size at onset of maturity of females in this area is ascribed to low water temperatures.
- 64 ANON. 1980: Control for rock lobster fisheries. *Catch 7(2)*: 3-4.  
Introduction of the Controlled Fishery for rock lobsters and reasons for it are described. The first area to be affected was Gisborne. Licensing and some associated problems are described.
- 65 ANON. 1980: The rock lobster research programme. *Catch 7(7)*: 18.  
This issue of *Catch* contains a large section on rock lobsters and rock lobster research. This introduction describes the rock lobster group, work done, and basic rock lobster biology.
- 66 ANON. 1980: Distribution and biology. *Catch 7(7)*: 18-19.  
A brief summary of red rock lobster life history.
- 67 ANON. 1981: Gisborne fishery causes grief? *Catch 8(1)*: 9.  
This report of a meeting between MAF and fishermen at Gisborne outlines four problems with the Gisborne fishery; one is trouble with the tail length measure. The fishermen promoted a carapace measure, and MAF promised further examination of the issue.
- 68 ANON. 1981: Carapace system for lobsters. *Catch 8(9)*: 28.  
As part of an attempt to change the legal size from tail length to a carapace length measure, industry was asked to make trials with a carapace gauge.

- 69 ANON. 1982: Fisheries papers at refrigeration conference. *Catch 9(3)*: 7-9.  
This article reports on several papers, including one given by N.E. Jarman of the Fishing Industry Board who suggested that regulations introduced to ensure the quality of tails removed at sea were not appropriate to the real requirements of the industry.
- 70 ANON. 1982: Rock lobster fisheries policy statement. *Catch 9(5)*: 29-31.  
Ministerial policy for the rock lobster Controlled Fishery is outlined. A table gives the targets for vessel numbers in each Controlled Fishery area. Guidelines for issue of licences by the Fisheries Licensing Authority are given.
- 71 ANON. 1982: New return forms. *Catch 9(9)*: 12-13.  
Rock lobster forms already in place at this time are illustrated in this general article. Only a small change to the existing rock lobster form was made at this point.
- 72 ANON. 1982: Rock lobster review. *Catch 9(9)*: 26.  
A short note describes the establishment of a MAF/industry committee to examine the proposed regulations governing tailing at sea.
- 73 ANON. 1983: Rock lobster date cancelled. *Catch 10(3)*: 6.  
In the tailing-at-sea area, rock lobster fishermen had been expected to comply with new standards for freezing tails removed at sea (Nos. 253, 267, 268). This deadline was set back pending the report of a working group (see No. 72).
- 74 ANON. 1983: New rock lobster tagging project. *Catch 10(5)*: 21.  
This note asks for tagged rock lobsters to be returned for a reward. Tagging was conducted between Castlepoint and Banks Peninsula to study growth, movements, and size at maturity.
- 75 ANON. 1983: Rock lobster investigated. *Commercial Fishing 22(5)*: 10-11.  
Rock lobster biology, movements, hydrology, and results from research programmes are presented for the area from Kaikoura to Banks Peninsula.
- 76 ANON. 1984: Possible "shooting war" defused in east coast rock lobster fishery. *Commercial Fishing 23(2)*: 9.  
Conflict between the commercial fishery and the local population near Te Araroa was resolved at a meeting between the two groups. The meeting was organised by the police following complaints from fishermen about their floats being cut away and possibly shot at. The commercial fishermen agreed not to fish close to shore.
- 77 ANON. 1985: Rock lobster management policy underway. *N.Z. Fishing Industry Board Bulletin 86*: 10.  
Development of options for future management of the fishery is described. A working group agreed that management policy should include retention of the Controlled Fishery areas and ceilings on vessel numbers, allow regional pot limits, and allocate individual transferable quotas (ITQs).
- 78 ANON. 1985. Boundary settled for rock lobster fishermen. *Catch 12(3)*: 9.  
The original boundary between the Bay of Plenty and Gisborne Controlled Fishery areas was East Cape lighthouse. This was reviewed at the request of local fishermen in 1983-84, and Cape Runaway was evaluated as an alternative boundary. The boundary remained at East Cape.
- 79 ANON. 1986: Rock lobster fisheries: Proposed policy for future management. Fisheries Management Division, N.Z. Ministry of Agriculture and Fisheries, Wellington. 36 p.  
Prepared as a discussion document, this report describes a proposed system for managing the rock lobster fishery with individual transferable quotas (ITQs). History and current state of the fishery and management objectives are briefly described; then four possible management options are outlined. These are continuing the present

- Controlled Fishery system, introducing transferable licences, introducing transferable pot entitlements, and introducing ITQs. The proposed ITQ system is then described. Appendices give recent landings, pot-lifts, and catch rates for each of the 10 Controlled Fishery areas.
- 80 ANON. 1986: Rock lobster fisheries: Proposed management policy. Fisheries Management Division, N.Z. Ministry of Agriculture and Fisheries, Wellington. 28 p.  
This report was prepared as a discussion document for the proposed ITQ system after the proposals in No. 79 had been discussed with industry. It describes a revised proposal for the ITQ system. Appendices give reasons for Ministerial rejection of transferable pot entitlements, guidelines for the objection process, and recent catch and effort data for each area.
- 81 ANON. 1986: Carapace tail measurement agreement. *FishFed News*, April-May 1986: 20.  
This article describes the agreement made at the 1986 Conference of the Federation of Commercial Fishermen with respect to a new rock lobster size limit. Change from tail length to carapace length, previously agreed upon, was delayed for one year so that feasibility of tail width for a legal measure could be studied.
- 82 ANON. 1987: Proposed management policy for rock lobster. *Fisheries Bulletin*, N.Z. Ministry of Agriculture and Fisheries, 2(2): 1-4.  
A brief history of the ITQ management proposals (see Nos. 79, 80), a description of industry reaction to the second round of industry meetings, and discussion of the current proposal for management of the rock lobster fishery.
- 83 ANON. 1987: Proposed changes to rock lobster minimum size measures. *Catch 14(10)*: 22-23.  
This article describes the MAFFish proposal to introduce tail width as the minimum legal size measure. It describes the historical background, alternative options and their consequences, and discusses possible impacts on commercial catches of this change. In a box, the Minister invited industry comments on the proposal.
- 84 ANON. 1987: Proposed changes to tailing at sea restrictions. *Catch 14(10)*: 22.  
MAFFish proposed a review of the restrictions on tailing at sea, which became less important after introduction of the tail width measure. Industry would be invited to participate in the review.
- 85 ANON. 1987: Preliminary findings: Rock lobster tailwidth measure. *N.Z. Professional Fisherman 1(1)*: 13.  
This article presents results of early examination of the feasibility of tail width as a size measure.
- 86 ANON. 1987: On the road to a better measurement system. *N.Z. Professional Fisherman 1(6)*: 26.  
A brief article reporting on a MAFFish examination of the feasibility of tail width and carapace length measures and presenting the N.Z. Federation of Commercial Fishermen's viewpoint on the proposed change away from tail length as a measure of legal size.
- 87 ANON. 1988: Red rock lobster tail width measure. *Catch 15(4)*: 3-4.  
Conversion of the minimum legal size from a tail length to a tail width, effective 1 June 1988, is described.
- 88 ANON. [1988]: Lobsters alive! Handling and measuring rock lobsters. *N.Z. Fisheries Information Series No. 14*: 7 p.  
This booklet aims to persuade fishermen to handle lobsters carefully,

- both to improve survival of discards and to improve quality of landed product. Handling procedures and their rationale are described. The new tail width measuring gauge is described and illustrated, with instructions on its use.
- 89 ANON. 1988: Questions and answers on the rock lobster fishery. *Catch 15(4)*: 4-6.  
Issues of interest to fishermen, especially concerning the new tail width measure (Nos. 83, 87) and current state of the resource (No. 141), are discussed in a question/answer format.
- 90 ARBUCKLE, G. 1971: The development of the crayfishing industry. In G. Arbuckle (Ed.), "Chatham Islands in Perspective - a Socio-economic Review", pp. 21-26. Hicks Smith, Wellington.  
Development of fishing at the Chatham Islands from 1965 is described. Some associated problems and future prospects are discussed.
- 91 ARCHEY, G. 1916: Notes on the marine crayfish of New Zealand. *Transactions and Proceedings of the N.Z. Institute 48*: 396-406.  
Previous descriptions of *J. edwardsii* and *J. verreauxi* are reviewed, and the species are each described (as *J. lalandii* and *J. hugelii* respectively). Larval stages are also described.
- 92 AYLING, A.M. 1978: Okakari Point to Cape Rodney Marine Reserve a biological survey. *Leigh Laboratory Bulletin 1*. 98 p.  
Rock lobsters in three broad size classes were counted in 32 transects, each of 500 square metres, in the Cape Rodney-Okakari Point Marine Reserve. *J. edwardsii* and *J. verreauxi* were counted separately. Lobsters were most abundant in broken rock and *Ecklonia* forest. Counts from each transect are provided for comparison with later surveys (e.g. No. 209).
- 93 AYSON, L.F. 1924: "New Zealand Fish and Fisheries". Government Printer, Wellington. 33 p.  
Exploratory government trawling expeditions, 1900-1908, are summarised by the Chief Inspector of Fisheries. He considered that "the crayfish grounds are very extensive" and predicted development of an export canning industry for rock lobsters.
- 94 BAIN, J. 1967: Investigations into the effectiveness of escape gaps in crayfish traps. *Fisheries Technical Report No. 17*. 22 p.  
Experimental traps with escape gaps were fished from commercial vessels alongside commercial traps at Cape Campbell and Motunau. At Cape Campbell the experimental traps caught the same number of legal lobsters and fewer sublegals; at Motunau the results were inconclusive. The author gives detailed trap descriptions and discusses effects of bait, soak time, etc. Landings and values are given for 1961-65.
- 95 BAIN, J. 1967: Total length/carapace length in crayfish (*Jasus lalandii*). *Fisheries Technical Report No. 23*. 17 p.  
In anticipation of a change from the contemporary total length measure to a carapace length size limit, morphometric comparison of these two measures was made based on data collected during the study described in No. 94. Original data are given, but sexes are not distinguished.
- 96 BAIN, R. 1967: Use of escape gaps in crayfish traps. *Commercial Fishing 6(11)*: 25.  
A popular summary of the results presented in No. 94. Pots with escape gaps caught at least as many (and sometimes more) legal-sized lobsters as pots without; they caught fewer sublegal lobsters.
- 97 BATHAM, E.J. 1967: The first three larval stages and feeding behaviour of phyllosoma of the New Zealand palinurid crayfish *Jasus edwardsii* (Hutton 1875). *Transactions of the Royal Society of N.Z., Zoology 9(6)*: 53-64.  
Naupliosoma and phyllosoma stage I and II larvae are described and illustrated. Hatching and larval development are described. Some feeding

- experiments are described, and the author suggests that phyllosomas may be benthic scavengers rather than planktonic feeders. Length of the larval life phase is estimated to be 9-12 months.
- 98 BAXTER, A.S. 1987: Kapiti Island marine recreational survey. Central Fishery Management Area Internal Report, N.Z. Ministry of Agriculture and Fisheries, 87/3. 17 p.  
A short survey of recreational fishing around Kapiti Island in the summer of 1986 involved both an access point survey and a diary programme. For rock lobsters, the mean catch was 0.35 lobsters per boat-day or handgathering-day in the diary programme, and 1.4 per day in the access point survey.
- 99 BAXTER, A.S., and HOLTON, A.L. 1986: Regional background paper for the Central Area rock lobster fishery. Central Region, N.Z. Ministry of Agriculture and Fisheries, Hastings. 55 p. (Draft report, held in Fisheries Research Centre library, Wellington.)  
The fishery and biology of *J. edwardsii* are reviewed generally. Fishery histories and specific fishing methods are then reviewed for each of three areas (east coast, Cook Strait, and Egmont) in the Central Region. Landings and efforts (numbers of vessels) are given for each of the controlled fishery areas within the Central Region. Size structures of the rock lobster fleets are given for Gisborne-Hawkes Bay, Wairarapa and Wellington, and Egmont.
- 100 BEST, E. 1929: Fishing methods and devices of the Maori. *Dominion Museum Bulletin* 12. 230 p.  
A section describes various methods used to take *koura*, or "crayfish", which term in the article refers variously to both crayfish and rock lobsters. Methods described include diving, netting, hoop-netting, and potting. James Cook is quoted describing the Maori catching lobsters by "diving near the shore and finding out where they lie with their feet."
- 101 BINNENDIJK, I. 1980: The tail of a rock lobster. *Catch* 7(7): 25.  
Development of the rock lobster tail from puerulus to adult is seen in a series of 6 photographs and micrographs.
- 102 BINNS, R., and PETERSON, A.J. 1969: Nitrogen excretion by the spiny lobster *Jasus edwardsii* (Hutton): the role of the antennal gland. *Biological Bulletin (Woods Hole)* 136: 147-153.  
Most nitrogen excreted by *J. edwardsii* is non-urinary in origin and the antennal gland is not important as far as total nitrogen loss from the animal is concerned.
- 103 BISHOP, S. 1987: Rock lobster tail width measure status report. *Professional Fisherman* 1(5): 11.  
A summary of progress in the study of feasibility of a minimum legal size based on tail width.
- 104 BOLT, C., and BOOTH, J.D. 1983: Rock lobster settlement rates. *Catch* 10(10): 23.  
General larval and puerulus biology is summarised. An experiment is described in which collectors were set at different depths at Napier for 5 weeks. Most puerulus were collected close inshore, and the authors conclude that shallow collectors can be used to monitor settlement.
- 105 BOOTH, J.D. 1974: Collection of larval rock lobsters. *Catch* 1(7): 9-10.  
Describes the early life-stage biology of rock lobsters and two prototype collectors used to measure settlement rate.
- 106 BOOTH, J.D. 1978: Recruitment study needs much work. *Catch* 5(7): 29.  
Describes the background biology of rock lobster larvae, results from early puerulus settlement research, and the need for settlement data in management of the fishery.



- 107 BOOTH, J.D. 1979: Settlement of the rock lobster, *Jasus edwardsii* (Decapoda: Palinuridae), at Castlepoint, New Zealand. *N.Z. Journal of Marine and Freshwater Research* 13: 395-406.  
Puerulus were caught on two types of submerged collector and by shore sampling. A collector of plywood crevices is identified as the best sampling tool. Seasonality of settlement (December to July) and possible factors influencing settlement are discussed. Size frequency distributions are presented.
- 108 BOOTH, J.D. 1980: Larval recruitment studies. *Catch* 7(7): 22-23.  
Goals and procedures of the puerulus settlement monitoring programme are reviewed. The results presented in No. 107 are summarised, along with those of offshore larval surveys.
- 109 BOOTH, J.D. 1980: Biological area studies: Tauroa (Reef) Point. *Catch* 7(7): 27.  
A brief summary of growth and movements in lobsters tagged in this area. Catch sampling indicated good recruitment.
- 110 BOOTH, 1981: Rock lobster farming. *Catch* 8(5): 13.  
The problems and potential of rock lobster culture are briefly described.
- 111 BOOTH, J.D. 1982: ... and rock lobsters elsewhere. *Catch* 9(10): 16.  
A companion article with No. 34 describes movement patterns shown by about 600 tag returns from various locations around New Zealand. Movements in the North Island appear to be small compared with those in the southern South Island.
- 112 BOOTH, J.D. 1983: Chatham Islands rock lobster study. *Catch* 10(1): 13-16.  
The sizes of lobsters landed in the Chatham Islands are described, along with size at onset of maturity. Puerulus settlement rates and factors that affect them are discussed.
- 113 BOOTH, J.D. 1983: Rock lobster investigated. *Commercial Fishing* 22(5): 10-11.  
This article focuses on the possible recruitment mechanism for the area between Kaikoura and Banks Peninsula. It discusses movement patterns determined from tagging, patterns of puerulus settlement, water movements, and fishery landings.
- 114 BOOTH, J.D. 1983: Power station attracts rock lobster larvae. *Catch* 10(5): 15.  
Although the local fishery is small, and puerulus collectors placed nearby caught nothing, many puerulus were caught on the cooling water intake screens at the New Plymouth power station. The author suggests that the station might attract puerulus with sound or vibration.
- 115 BOOTH, J.D. 1983: Getting the drift of lobster larvae. *Catch* 10(8): 12.  
Studies of the current patterns in the Tasman Sea near the northern part of New Zealand are described. Drogues and drift cards were used. Emphasis in this article is on packhorse rock lobster, *J. verreauxi*, but the results have implications for red rock lobsters in northern New Zealand.
- 116 BOOTH, J.D. 1983: Canterbury-Marlborough rock lobster fishery. *Catch* 10(11): 24-27.  
History of the fishery in this area, hydrology and current patterns affecting the area, recent landing trends, puerulus settlement trends, movement patterns and future stock trends are discussed.
- 117 BOOTH, J.D. 1984: FRD scientist's research suggests possible marked decline in South Island rock lobsters. *Commercial Fishing* 23(2): 2-5.  
Puerulus settlement rates onto collectors were high between East Cape and Cook Strait, but much lower at all other collector sites. Some

- evidence for decreasing settlement at Kaikoura and Castlepoint is presented. Migration patterns are discussed. After considering limitations of the data, the author suggests that future catches could decrease and that recruitment over-fishing might even be taking place.
- 118 BOOTH, J.D. 1984: Rock lobster fishery causes concern. *Catch 11(2)*: 12, 21-23.  
Decreased landings and puerulus settlement rates in the South Island are discussed. Implications suggested are possible further decreases in landings, the possibility of recruitment failure, and a possible need for catch restrictions (cf. No. 1).
- 119 BOOTH, J.D. 1984: Trawl caught rock lobsters wanted. *Catch 11(8)*: 23.  
A notice requesting that trawlers report concentrations of lobsters so that tagging could be carried out to study migrations in the Bay of Plenty, Gisborne, and northeast South Island areas.
- 120 BOOTH, J.D. 1984: Interest in ongrowing rock lobsters. *Catch 11(9)*: 9-10.  
A discussion of the economic, biological, and social problems that would affect grow-out of juvenile rock lobsters in a commercial scheme. In addition to the problems identified in No. 214, this study cites diseases and fishery management concerns as obstacles to development of rock lobster culture.
- 121 BOOTH, J.D. 1985: MAF scientist up-dates lobster study. *Commercial Fishing 24(7)*: 12-13.  
High 1984 landings appear to be related to previous high puerulus settlement in Gisborne and Wellington/Hawkes Bay, and low settlement in 1980 in Otago is reflected in low landings there. The broad patterns described in No. 117 continued to hold. General implications of puerulus settlement for future landings are discussed, and the limitations of such predictions presented.
- 122 BOOTH, J.D. 1986: Rock lobsters of New Zealand. *N.Z. Dive 8(6)*: 43-47.  
A popular article summarising taxonomy, life cycle, sexuality and breeding, feeding and growth, behaviour, movements, and predators.
- 123 BOOTH, J.D. (in press): History of biological research into the rock lobsters of New Zealand. *CSIRO (Australia) Division of Fisheries Circular*.  
Keyword and geographical indexes are provided.
- 124 BOOTH, J.D., ANNALA, J.H., and MCKOY, J.L. 1978: Group's studies help keep fishery. *Catch 5(7)*: 26-27.  
A summary of work in progress at five locations. Results of tagging studies, catch sampling and puerulus collection are described.
- 125 BOOTH, J.D., and BOWRING, L.D. (in press): Decreased abundance of the puerulus stage of the rock lobster, *Jasus edwardsii*, at Kaikoura, New Zealand. *N.Z. Journal of Marine and Freshwater Research*.  
Both shore collections and nighttime spot-lighting produced more puerulus stage lobsters in the period 1967-72 than in 1984-87. Since 1980, subtidal collectors at Kaikoura have caught few puerulus compared with east coast North Island collectors. The authors discuss several explanations for what they suggest is a decline in puerulus abundance at Kaikoura.
- 126 BOOTH, J.D., and MIDGLEY, E. 1980: Biological area studies: Banks Peninsula. *Catch 7(7)*: 27.  
A summary of growth and movement in lobsters tagged on Banks Peninsula.
- 127 BOOTH, J.D., and TARRING, S. 1982: Settlement of larval rock lobsters. *Catch 9(6)*: 10-11, 13-14.  
Settlement intensity and seasonality in different parts of New Zealand are described, based on findings from the puerulus collector programme.

- 128 BOOTH, J.D., and TARRING, S.C. 1986: Settlement of the red rock lobster, *Jasus edwardsii*, near Gisborne, New Zealand. *N.Z. Journal of Marine and Freshwater Research* 20: 291-297.  
A refined version of the puerulus collector is described and illustrated. Seasonality of settlement at Gisborne was different from that in other areas. Size frequency distributions are presented. The authors suggest that sets of collectors can be used to monitor annual settlement intensity for eventual use in understanding variation in catch.
- 129 BOWEN, B.K. 1980: Spiny lobster fisheries management. In J.S. Cobb and B.F. Phillips (Eds.), "The Biology and Management of Lobsters. Vol. II, Ecology and Management", pp. 243-264. Academic Press, New York.  
Although this article deals mostly with the Western Australian fishery for *Panulirus cygnus*, the New Zealand fishery for *J. edwardsii* is mentioned in passing. A general conclusion of the article is that for most major spiny lobster fisheries, "annual total production is likely to fall quite dramatically unless controls are placed on the total fishing effort."
- 130 BOYD, N.S., and SUMNER, J.L. 1973: Research report: Effect of rock lobsters' biological condition when tailed on the organoleptic quality of frozen tails. *Commercial Fishing* 12(7): 18-19.  
A report showing that a considerable loss in flavour occurs before rock lobsters are dead. It is suggested that to maintain a high quality product, rock lobsters should be as lively as possible at tailing.
- 131 BRADSTOCK, C.A. 1948: A study of the marine spiny crayfish, *Jasus lalandii* (Milne-Edwards). Unpublished MSc thesis, Victoria University of Wellington, Wellington. 79 p.  
This study was conducted at Wellington in 1947-48. Seasonal variations in size and sex structure of the catch are described, and the reproductive cycle is outlined. Fecundity is described. An informal analysis of the size limit showed that it protected immature females without reducing catches substantially. Growth and migration were examined in a small tagging study. The relation between size and meat weight is given, and the importance of meat from various parts of the body discussed. Cooking is shown to decrease the carapace length. Patterns of limb loss, and times required to regenerate limb parts, are described.
- 132 BRADSTOCK, C.A. 1948: An apparatus for counting large numbers of small eggs. *N.Z. Science Review* 6: 12.  
A description of an apparatus developed for counting rock lobster eggs.
- 133 BRADSTOCK, C.A. 1950: A study of the marine spiny crayfish *Jasus lalandii* (Milne-Edwards) including accounts of autotomy and autospasy. *Zoology Publications from Victoria University of Wellington No. 7*. 38 p.  
A condensed version of No. 131.
- 134 BRADSTOCK, C.A. 1953: Biology of the marine spiny crayfish *Jasus lalandii* (Milne-Edwards) in New Zealand waters. *Proceedings of the Seventh Pacific Science Congress of the Pacific Science Association* 4: 504-506.  
A brief review of the work described in No. 131.
- 135 BRADSTOCK, M., and MCKENZIE, L. 1981: The Tasman Bay slime story. *Catch* 8(11): 29-30.  
"Slime" outbreaks, caused by periodic heavy growth of diatoms, may interfere with trawling and lobster potting. Significant catches of slime were reported on the *Nora Niven* expeditions (Nos. 93, 301). This

- article describes an episode in Tasman Bay and observations reported by divers.
- 136 BRANSON, A. 1981: Rock lobster Controlled Fisheries (Part I). *Catch 8(4)*: 4-7.  
A brief introduction is given to the Controlled Fishery, then participants in the Northland, Bay of Plenty, and Gisborne fisheries are listed.
- 137 BRANSON, A. 1981: Rock lobster Controlled Fisheries (Part II). *Catch 8(5)*: 21-23.  
Controlled Fishery licence holders in Wellington/Hawkes Bay, Canterbury/Marlborough, and Taranaki areas are listed.
- 138 BRANSON, A. 1981: Rock lobster Controlled Fisheries (Part III). *Catch 8(6)*: 9-15.  
Controlled Fishery licence holders in Otago, Southern, and Westland areas are listed.
- 139 BRANSON, A. 1981: Rock lobster Controlled Fisheries (Part IV). *Catch 8(10)*: 15-26.  
The last article in the series lists licence holders in the Chatham Islands Controlled Fishery.
- 140 BREEN, P.A., and BOOTH, J.D. 1986: Rock lobster tail width studies. *N.Z. Professional Fisherman 1(3)*: 18-19.  
In 1986 the feasibility of a tail width measure as a size limit was investigated. This progress report describes the precision of various measurements and their stability during processing operations.
- 141 BREEN, P.A., BOOTH, J.D., and CHANT, K. 1988: Current state of the rock lobster fishery. *Catch 15(1)*: 26-27, 30-31.  
This article contends that the *J. edwardsii* resource is stressed, that biological and economic performances of the fishery are not what they could be, and that the resource is not in a safe state. This contention is based on catch and effort analyses, catch composition, and yield- and egg-per-recruit analyses.
- 142 BREEN, P.A., BOOTH, J.D., and TYSON, P.J. 1987: Measurements for new rock lobster size limit. *Catch 14(7)*: 13-15.  
Results are presented from a study examining the feasibility of tail width as a minimum legal size. The authors compared the precision of tail width, carapace length, and tail length, and examined the effects of processing operations on tail width and carapace length. The equivalent tail widths and carapace lengths for males and females, corresponding to tail lengths of 152 and 127 mm, are presented.
- 143 BREEN, P.A., BOOTH, J.D., and TYSON, P.J. 1988: Feasibility of a minimum size limit based on tail width for the New Zealand rock lobster *Jasus edwardsii*. *N.Z. Fisheries Technical Report No. 6*. 16 p.  
Estimates of the precision of tail length, tail width, and carapace length measurements are given. The authors subjected rock lobsters to various processing operations and measured the stability of these measures. Morphometric relations among these measures are given for each of 42 samples and 7 controlled fishery areas. A weighted relationship between tail length and tail width is derived for New Zealand as a whole. This study facilitated the 1988 change from a minimum legal size based on tail length to one based on tail width.
- 144 BROAD, C. 1982: Serious problems face Stewart Island. *Catch 9(10)*: 28.  
Special problems facing the Stewart Island fishery are presented, along with one side of a controversy over the quality of tails frozen at sea.

- 145 BYCROFT, B.L. 1984: Rock lobster egg measuring technique devised. *Catch 11(11)*: 17.  
Describes a technique used to count the eggs mechanically on a female rock lobster for fecundity studies (see also No. 146).
- 146 BYCROFT, B.L. 1986: A technique for separating and counting rock lobster eggs. *N.Z. Journal of Marine and Freshwater Research 20*: 623-626.  
A technique is described for separating eggs from setae, and an electronic counting system is outlined. Both accuracy and precision of the method were tested.
- 147 BYCROFT, B.L. 1986: Stewart Island rock lobster monitoring continues. *Catch 13(11)*: 16.  
Puerulus settlement rates at Halfmoon Bay from 1980 are briefly discussed and the size frequencies of juveniles caught by divers from 1983 to 1986 are shown. The relation between puerulus settlement and juvenile abundance appears to be close.
- 148 BYCROFT, B.L., and ANNALA, J.H. 1984: Results of Stewart Island rock lobster sampling. *Catch 11(9)*: 10.  
Summary of the final results of growth studies (No. 25) on juvenile rock lobsters at Stewart Island. Implications for rock lobster culture are discussed.
- 149 BYCROFT, B.L., MCKOY, J.L., and ANNALA, J.H. 1983: Rock lobster growth rates. *Catch 10(5)*: 16.  
Preliminary growth rates of juvenile lobsters at Stewart Island, estimated from tagging and size frequency distributions, are presented. See Nos. 25 and 148 for updated summaries.
- 150 CAIRNS, N.D. 1985: Assessment of the Kaikoura amateur fishery for rock lobsters. Unpublished MSc thesis, University of Canterbury, Christchurch. 86 p.  
Catches by amateur divers and potters were estimated for one season in the Kaikoura area. The catch was estimated to be 25 tonnes (the reported commercial catch for that area was 376 tonnes). Confidence limits are given for all estimates. The survey techniques used are evaluated and a 'user value' for amateur fishing for making comparisons with the commercial fishery is discussed.
- 151 CHAPLIN, J.M. 1973: Aspects of the biology of growth in the New Zealand rock lobster *Jasus edwardsii*. Unpublished MSc thesis, University of Otago, Dunedin. 117 p.  
A review of the literature on the metabolic and physical changes which take place during moult cycles of crustaceans is given. Density, water content, and hepatopancreas fresh weight were determined for *J. edwardsii* at broad stages in the moult cycle. Calcium, lipid, and protein were analysed in hepatopancreas tissue, blood, and chitin. Ash and calcium determinations were made for the integument. Some data on the organic and inorganic composition of the first stage phyllosoma are presented.
- 152 CHAPMAN, L.P.J. 1972: Handling of rock lobster. In "Report on Quality in Fish Products Seminar, August 1971", pp. 83-85. N.Z. Fishing Industry Board, Wellington. 100 p.  
The conditions under which rock lobsters should be tailed, frozen, packed, and stored and the importance of meeting these conditions for the export market are discussed. The need for a high standard of hygiene, rapid freezing, and storage temperatures lower than 20°F (-7°C) is stressed.

- 153 CHILTON, C. 1907: Crustacea. *Records of the Canterbury Museum* 1(1): 285-312.  
Includes a very short note (pp. 303-304) on the synonymy of *J. edwardsii* and anecdotal information on abundance and sex ratios at the Chatham Islands and Dusky Sound.
- 154 CLAY, A.H. 1970: The Chatham Islands rock lobster industry. Unpublished MA thesis, University of Canterbury, Christchurch. 150 p.  
A review of the socio-economic and political history of the Chatham Islands and an account of the development of the rock lobster fishery and its relationship to the fishery in the rest of New Zealand. The effects of the fishery on the islands are reviewed and problems for future development discussed.
- 155 CLEMENT, I.T. 1987: Rock lobster measurements. *N.Z. Professional Fisherman* 1(8): 13-15.  
Subtitled "The change in minimum size in rock lobster: or why does it take MAF so long to do something that appears so simple?". An historical review of the size limit measurement issue and a description of the obvious options and their advantages and disadvantages.
- 156 COBB, J.S., and WANG, D. 1985: Fisheries biology of lobsters and crayfishes. In A.J. Provenzano (Ed.), "The Biology of Crustacea, Vol. 10, Economic Aspects: Fisheries and Culture", pp. 167-247. Academic Press, New York.  
A general review of lobster fishery biology, including several aspects of *J. edwardsii* reported elsewhere. These include migration (No. 283), the possibility that *J. novaehollandiae* may be the same species as *J. edwardsii* (No. 272), and variation in growth rate (No. 222).
- 157 COLENZO, W. 1892: Reminiscences of the ancient Maoris. VIII. Of the peculiar modes of preparing some articles of animal food, as practised by the ancient Maoris. *Transactions and Proceedings of the N.Z. Institute* 24: 461-463.  
Colenso describes marine *koura* being caught in great numbers during November. These were held down in freshwater streams with stones until dead, then shucked, compressed, dried in the sun, and stored for use later in flax baskets.
- 158 COOMBS, R.F. 1972. Device for detecting and measuring activity of large marine crustaceans. *N.Z. Journal of Marine and Freshwater Research* 6: 194-205.  
A simple and inexpensive system for continuously detecting and recording movement of *J. edwardsii* in a laboratory tank is described.
- 159 COOMBS, R.F. 1974: Crayfish (1). *New Zealand's Nature Heritage, Part 26*: 725-732.  
A brief review of the distribution, anatomy, life cycle, biology, habits, and behaviour of *J. edwardsii* in New Zealand.
- 160 COOMBS, R.F. 1974: Crayfish (2). *New Zealand's Nature Heritage, Part 27*: 740-745.  
A brief description and summary of landings, catching methods, management, and regulations in the New Zealand rock lobster fishery.
- 161 CRUMP, A. 1969: Preliminary tests of length of survival of embryos of crayfish (*Jasus edwardsii*) after removal from seawater. Portobello Marine Biological Station, University of Otago. 4 p. (Unpublished MS, held in Fisheries Research Centre library, Wellington.)  
Females bearing late-stage eggs were held out of water in the shade, at temperatures of 11.5 - 14.6°C and relative humidities around 70%. After 4 hours, nearly all embryos were still alive. This suggests that normal handling aboard fishing vessels does not harm larvae carried by berried females. The author cautions that younger embryos were not tested, and that more severe conditions would accelerate mortality.

- 162 CUNNINGHAM, B.T. 1966: Fishing industry. In A.H. McLintock (Ed.) "An encyclopaedia of New Zealand", pp. 679-687. Government Printer, Wellington.  
The lobster fishery is described in the context of the fishing industry of that time. The distribution of landings is illustrated.
- 163 DALZIELL, J.C., and KERR, G.N. 1988: Approaches to measuring the amateur catch of rock lobsters. Centre for Resource Management, University of Canterbury, Christchurch. 68 p. (Unpublished report to the N.Z. Ministry of Agriculture and Fisheries, held in Fisheries Research Centre library, Wellington).  
The methodology of estimating amateur rock lobster catches, both in New Zealand as a whole and in smaller areas, is discussed. Four different theoretical approaches and a variety of practical approaches are considered. Statistical and cost considerations are given for each approach. A preferred strategy is outlined, based on information available to the authors.
- 164 DEAN, I.C. 1979: Activity patterns in the New Zealand crayfish *Jasus edwardsii* (Hutton). Unpublished BSc (Hons) thesis, University of Otago, Dunedin. 75 p.  
Diurnal activity is described, controlled mostly by the ambient light cycle and partly by endogenous rhythm in some animals. Lobsters are opportunistic, and the basic pattern of nocturnal foraging and feeding can be changed by many factors.
- 165 DICK, A.D. 1971: Fishing Industry Committee 1970-1971. *Appendix to the Journals of the House of Representatives of New Zealand. I.14.* 112 p.  
Discussion of the history and development of the New Zealand rock lobster industry is included, as well as aspects of economics, management, tailing at sea, the Karitane concession area, the Chatham Islands, utilisation of rock lobsters, enforcement of regulations, and research. The Committee's recommendations are included with each section.
- 166 DUNCAN, A.J. 1985: New Zealand's rock lobster fishery. A fishery at the crossroad. New Zealand Fishing Industry Board, Wellington. 12 p. (Unpublished report, held in Fisheries Research Centre library, Wellington.)  
This discussion paper identifies needs for transferability in the fishery, reduction of fishing effort, and improvement of economic return from the fishery. Several possible options to address some or all of these needs are discussed in general terms, including pot limits, transferable quotas, and royalties.
- 167 ELLERTON, H.D., BLAZEY, N.D., and ROBINSON, H.A. 1977: Hydrogen ion titration and amino acid analysis of hemocyanin from the spiny lobster *Jasus edwardsii*. *Biochimica et Biophysica Acta* 495: 140-150.  
Observations on the biochemical properties of haemocyanin are described and discussed.
- 168 ELLERTON, H.D., COLLINS, L.B., GALE, J.S., and YUNG, A.Y.P. 1977: The subunit structure of the hemocyanin from the crayfish *Jasus edwardsii*. *Biophysical Chemistry* 6: 47-57.  
Structural properties, molecular weights, and oxygen binding properties of haemocyanin are described.
- 169 ELLERTON, H.D., ELLERTON, N.F., and ROBINSON, H.A. 1983: Hemocyanin - a current perspective. *Progress in Biophysics and Molecular Biology* 41: 143-248.  
This comprehensive review of haemocyanin includes results from all three species in the '*Ialandii*' subgroup.

- 170 FISHING INDUSTRY BOARD. 1968: Report on crayfish: Chatham Islands and Western Australia. N.Z. Fishing Industry Board, Wellington. 50 p. (Unpublished report, held in N.Z. Fishing Industry Board library, Wellington.)  
The first section discusses problems in the Chatham Islands fishery with particular reference to quality problems in rock lobster tails, safety at sea, the welfare and development of the Chatham Islands, and conservation of the fishery. Desirable objectives are briefly defined and a wide range of recommendations on these points is presented.
- 171 FOGARTY, M.J., and MURAWSKI, S.A. 1986: Population dynamics and assessment of exploited invertebrate stocks. In G.S. Jamieson and N.F. Bourne (Eds.), "North Pacific Workshop on Stock Assessment and Management of Invertebrates", pp. 228-244. *Canadian Special Publication of Fisheries and Aquatic Sciences* 92.  
Two surplus production models are applied to the time series of catch and effort data for *J. edwardsii*. They gave maximum equilibrium yield estimates of 4400-4500 t.
- 172 GEORGE, R.W. 1969: Natural distribution and speciation of marine animals. *Journal of the Royal Society of Western Australia* 52(2): 33-40.  
Evolution of palinurids is discussed in the context of climate change over geological time. It is suggested that *J. edwardsii* in New Zealand and *J. novaehollandiae* in southeastern Australia originated together in the Macquarie Antipodean region, and that separation of the two species is maintained by bottom types and by patterns of water circulation.
- 173 GEORGE, R.W., and KENSLER, C.B. 1970: Recognition of marine spiny lobsters of the *Jasus lalandii* group (Crustacea: Decapoda: Palinuridae). *N.Z. Journal of Marine and Freshwater Research* 4: 292-311.  
A key to the genus *Jasus* is presented. The distribution and diagnostic features of the six species in the *J. lalandii* group are reviewed, tabulated, and illustrated.
- 174 GEORGE, R.W., and MAIN, A.R. 1967: The evolution of spiny lobsters (Palinuridae): a study of evolution in the marine environment. *Evolution* 21: 803-820.  
The evolution of the various genera within the family is discussed in the context of their distribution, ecology, and fossil history.
- 175 GILBERG, Y.C. 1968: Crayfish and its commercial utilisation. *Commercial Fishing* 7(9): 30, 32, 34, 36-38.  
A brief description of the New Zealand rock lobster fishery and processing research. Some comments are made on the physiology and moulting cycle of decapods. Data on biochemical composition (percentage moisture, protein, non-protein, lipids) are presented.
- 176 HERNNKIND, W.F. 1980: Spiny lobsters: patterns of movement. In J.S. Cobb and B.F. Phillips (Eds.), "The Biology and Management of Lobsters. Vol. I. Physiology and Behaviour", pp. 349-407. Academic Press, New York.  
In this review paper the migratory patterns described by Street (Nos. 283, 285) are compared with those of other species.
- 177 HICKMAN, R.W. 1972: Rock lobsters feeding on oysters. *N.Z. Journal of Marine and Freshwater Research* 6: 641-644.  
Captive rock lobsters were able to open and eat live dredge oysters.
- 178 HOLTHIUS, L.B. 1946: Biological results of the Snellius Expedition. XIV. The Decapoda Macrura of the Snellius Expedition. I. The Stenopodidae, Nephropsidae, Scyllaridae and Palinuridae. *Terminckia* 7. 178 p.  
*Jasus edwardsii* is considered here to be *Jasus lalandei* var. *frontalis*.



- 179 HOLTHIUS, L.B. 1963: Preliminary descriptions of some new species of Palinuridae. *Koninklijke Nederlandse Akademie van Wetenschappen, Series C*, 66: 54-60.  
Some of the differences between *J. edwardsii* and other closely related species *J. novaehollandiae*, *J. lalandii*, *J. frontalis*, and *J. tristani* are described.
- 180 HOLTHIUS, L.B., and SIVERTSEN, E. 1967: The Crustacea Decapoda, Mysidacea and Cirripedia of the Tristan da Cunha Archipelago with a revision of the '*frontalis*' subgroup of the genus *Jasus*. *Results of the Norwegian Scientific Expedition to Tristan da Cunha 1937-1938* 52: 50 p. The authors review the taxonomy of the genus *Jasus* after having examined material of all forms. They divide the genus into two subgeneric groups: the '*verreauxii*' group (*J. verreauxi*) and the '*lalandii*' group (all other species). Then they suggest two subgroups: '*lalandii*', comprising *J. lalandii*, *J. edwardsii*, and *J. novaehollandiae*; and '*frontalis*', comprising *J. frontalis*, *J. paulensis*, and *J. tristani*. This is the currently accepted scheme.
- 181 HUTTON, F.W. 1875: Description of two new species of Crustacea from New Zealand. *Transactions and Proceedings of the N.Z. Institute* 7: 279-280.  
The original description of *J. edwardsii*.
- 182 KABERRY, A.C. 1957: Sea fisheries. In F.R. Callaghan (Ed.), "Science in New Zealand", 1957 ANZAAS Congress handbook, pp. 88-96. A.H. & A.W. Reed, Wellington.  
A brief description of the rock lobster fishery and other major fisheries. Landings, 1943-55, and major areas of catch are illustrated.
- 183 KABERRY, A.C., and PIKE, R.B. 1967: The New Zealand crayfishery. Australian/New Zealand Meeting on Decapod Crustacea, 1967, Sydney, Australia. Document 67/2/17. 19 p. (Unpublished report, held in Fisheries Research Centre library, Wellington.)  
A short historical account is given of the fishery, including data on rock lobster landings by port and region, size of boats, and numbers of licences and size composition of exported rock lobsters. There are also data on the relations between carapace length, tail width, total length, and tail length.
- 184 KABERRY, A.C., and PIKE, R.B. 1967: Regulatory controls covering crayfish. A short historical review. Australian/New Zealand Meeting on Decapod Crustacea, 1967, Sydney, Australia. Document 67/2/8. 8 p. (Unpublished report, held in Fisheries Research Centre library, Wellington.)  
Past and present regulations in New Zealand specifically concerned with rock lobsters are summarised, as are the conclusions of the 1956 and 1962 Fisheries Committees (Nos. 165, 266).
- 185 KANCIRUK, P., and HERNNKIND, W.F. (Eds.) 1976: An indexed bibliography of the spiny lobsters, family Palinuridae. Florida Sea Grant Report 8 FLSGP-L-76-001. Florida State University, Gainesville. 101 p.
- 186 KANCIRUK, P., HERNNKIND, W.F., PHILLIPS, B.F., and ARNAUD, P.M. 1982: An indexed bibliography of the spiny (rock) lobsters (Decapoda: Palinuridae). *CSIRO Marine Laboratories Report* 141. 225 p.
- 187 KENSLER, C.B. 1966: Ecological notes on the marine crayfish *Jasus edwardsii* (Hutton): Puerulus and post-puerulus stages. *N.Z. Marine Sciences Newsletter* 8: 32-34.  
Puerulus and post-puerulus stages collected at Castlepoint were reared in aquaria. Growth and feeding of these specimens are briefly described, and other localities from which puerulus stages were collected are mentioned.

- 188 KENSLER, C.B. 1967: Notes on laboratory rearing of juvenile spiny lobsters, *Jasus edwardsii* (Hutton) (Crustacea: Decapoda: Palinuridae). *N.Z. Journal of Marine and Freshwater Research 1*: 71-75.  
Rearing of post-*puerulus* in the laboratory for periods of up to 12 months is reported. Feeding requirements and sensitivity to pollution are described.
- 189 KENSLER, C.B. 1967: The distribution of spiny lobsters in New Zealand waters (Crustacea: Decapoda: Palinuridae). *N.Z. Journal of Marine and Freshwater Research 1*: 412-420.  
The distribution of both *Jasus* species in New Zealand, including the Subantarctic islands, is described and occurrence of *J. edwardsii* at the Auckland Islands is confirmed.
- 190 KENSLER, C.B. 1968: Notes on fecundity in the marine spiny lobster *Jasus edwardsii* (Hutton) (Crustacea: Decapoda: Palinuridae). *N.Z. Journal of Marine and Freshwater Research 2*: 81-89.  
Fourteen berried females were investigated and a positive correlation was found between weight of eggs, number of eggs, and carapace length. Numbers of eggs carried ranged from 124 278 in a specimen of 9.5 cm carapace length to 538 242 in a specimen of 17.0 cm carapace length.
- 191 KENSLER, C.B. 1969: Commercial landings of the spiny lobster *Jasus edwardsii* (Hutton) at Chatham Islands, New Zealand (Crustacea: Decapoda: Palinuridae). *N.Z. Journal of Marine and Freshwater Research 3*: 506-517.  
Data are presented on landings and fishing effort (boat numbers and days fished) for the Chatham Islands during 1965-67. Size frequency distributions for males and females are compared with those from other parts of New Zealand.
- 192 KENSLER, C.B. 1969: Spiny lobster tails. A valuable New Zealand and Australian export. *Commercial Fishing 8(11)*: 35-37.  
A review of imports and prices of rock lobster tails into the United States from New Zealand and Australia, 1960-68.
- 193 KILNER, A., and GOODWIN, W. 1982: Cyclone Bernie kills lobsters. *Catch 9(6)*: 14-15.  
After the Easter 1982 cyclone, large numbers of juvenile rock lobsters were washed up dead on local beaches near Gisborne. Decreased salinity is suggested as the cause of this mortality.
- 194 KITTAKA, J., IWAI, M., and YOSHIMURA, M. 1988: Culture of a hybrid of spiny lobster genus *Jasus* from egg stage to *puerulus*. *Nippon Suisan Gakkaishi 54(3)*: 413-417.  
Hybrids were created between *J. edwardsii* and *J. novaehollandiae*. Hybrid phyllosomas were hatched from females of both species. Two larvae from a group of 1000 stage I phyllosomas from female *J. novaehollandiae* reached the final phyllosoma stage, and one reached the *puerulus* stage after 319 days. Larval development is compared with that of *J. lalandii*. This work has implications for both culture and evolutionary history of the two species.
- 195 LEACH, B.F. 1979: Fish and crayfish from the Washpool midden site, New Zealand: their use in determining season of occupation and prehistoric fishing methods. *Journal of Archaeological Science 6*: 109-126.  
Along with modern ecological evidence and fish bones from this midden, the author uses evidence from *J. edwardsii* mandibles to conclude that the site was occupied year-round.
- 196 LEACH, B.F., and ANDERSON, A.J. 1979: Prehistoric exploitation of crayfish in New Zealand. In A. Anderson (Ed.), "Birds of a Feather: Osteological and Archaeological Papers from the South Pacific in Honour of R.J.

Scarlett", pp. 141-164. *British Archaeological Reports, International Series 62*.

Mandibles of *J. edwardsii* were excavated from middens at Cape Palliser and the Chatham Islands. Morphometric relations between mandible size and other body measurements were determined from live material and used to determine sizes of lobsters taken in pre-history. These were significantly larger than most lobsters seen now, and the authors suggest that mean size is very slow to respond to decreased mortality rate.

- 197 LESSER, J.H.R. 1974: Identification of early larvae of New Zealand spiny and shovel-nosed lobsters (Decapoda, Palinuridae and Scyllaridae). *Crustaceana (Leiden)* 27: 259-277.  
The first three phyllosoma stages of *J. edwardsii* obtained from rearing experiments and from plankton samples are described. A key to the first stage phyllosoma larvae of *J. edwardsii*, *J. verreauxi*, and the scyllarid *Abacus alticrenatus* is provided.
- 198 LESSER, J.H.R. 1978: Phyllosoma larvae of *Jasus edwardsii* (Hutton) (Crustacea: Decapoda: Palinuridae) and their distribution off the east coast of the North Island, New Zealand. *N.Z. Journal of Marine and Freshwater Research* 12: 357-370.  
Eleven phyllosoma stages are described from plankton samples. Diagrams and a key to phyllosoma stages are provided. Mortality of larvae, estimated from a catch curve, is estimated to be 98%. Seasonal and spatial plankton distributions are described. Observations of pueruli in fish stomachs are reported.
- 199 LEVINE, H.B. 1983: Unsettled disputes and the social organization of a New Zealand crayfishing community. *Social Analysis* 13: 37-53.  
H.B. and M.W. Levine are anthropologists interested in the relationship between human community structure and resource exploitation. They spent 8 months living on Stewart Island as a family in 1981, and made other visits. During their study they formally interviewed all the fishing families on the island and obtained much information from less formal contacts. Based on this work they wrote a series of papers on social structure and its effect on fishing, which at Stewart Island is largely rock lobster fishing. In this paper they describe the island community and history of fishing there, then describe disputes arising in rock lobster fishing and how these disputes are resolved in the community.
- 200 LEVINE, H.B. 1984: Controlling access: forms of "territoriality" in three New Zealand crayfishing villages. *Ethnology* 23(2): 89-99.  
The three communities are Stewart Island, Ngawhi, and Motunau Beach. The fisheries for each area are described and forms of competitive exploitation of the available grounds are compared.
- 201 LEVINE, H.B. 1985: Entrepreneurship and social change: implications from a New Zealand case study. *Human Organization* 44(4): 293-300.  
This paper is based on the Stewart Island study (No. 199). It examines changes in the rock lobster fishery and social change there in the context of a model based on "entrepreneurship". A major conclusion is that fishery management plans have social effects, and that management plans should therefore incorporate "sociocultural" goals.
- 202 LEVINE, H.B., and M.W. LEVINE. 1983: Community structure and fishery management: a New Zealand case study. *Pacific Viewpoint* 24: 50-68.  
This paper examines the interaction between fishery management and social organisation, based on the Stewart Island study (No. 199).
- 203 LEVINE, M.W., and H.B. LEVINE. 1983: Socio-economic patterns and crayfishing zones: implications for managing the Stewart Island crayfishery. *New Zealand Geographer* [October 1983]: 83-85.

- 204 LEVINE, H.B., and LEVINE, M.W. 1987: Stewart Island: Anthropological perspectives on a New Zealand fishing community. *Victoria University of Wellington Occasional Publications in Anthropology* 1. 111 p.  
The several papers arising from the Stewart Island study are brought under one cover here.
- 205 LOCKE, E. 1976: "Crayfishermen and the Sea." Whitcoulls, Christchurch. 32 p.  
A school social studies resource book with a popular account of fishing in Fiordland and a brief description of rock lobster biology and fishery regulations.
- 206 LONG, D.S. 1985: Early crayfishing. *N.Z. Fishing Industry Board Bulletin* 84: 26-27.  
The history of fishing for rock lobster is described from Maori methods through the trade with Cook and early Europeans, and through the pre-Second World War fishery.
- 207 McCARDLE, I. 1983: Young paua in peril. *Catch* 10(11): 18.  
Rock lobsters are cited as predators of juvenile paua within the context of outplanting paua from hatcheries. Photographs illustrate shells of paua eaten by *J. edwardsii* and *J. verreauxi*.
- 208 MacDIARMID, A.B. 1985: Sunrise release of larvae from the palinurid rock lobster *Jasus edwardsii*. *Marine Ecology Progress Series* 21: 313-315.  
Egg hatching from female *J. edwardsii* was observed in both the field and laboratory. Most hatching took place just after sunrise. In the field, egg-bearing females congregated on deeper reefs. Naupliosoma larvae hatched from the eggs, and moulted to become stage I phyllosomas within 30 min.
- 209 MacDIARMID, A.B. 1987: The ecology of *Jasus edwardsii* (Hutton) (Crustacea: Palinuridae). Unpublished PhD thesis, University of Auckland, Auckland. 169 p.  
This work, conducted in the Cape Rodney-Okakari Point Marine Reserve, describes detailed patterns of distribution in *J. edwardsii*. It gives detailed distributions of rock lobsters with respect to size, sex, habitat, shelter, and depth. A visual census technique was developed for this project. Daily and seasonal changes in distribution are described and related to moulting and reproductive events. Growth and reproductive cycles are fully described. Comparisons are made between the Marine Reserve and adjacent populations.
- 210 MacDIARMID, A.B. 1988: Experimental confirmation of external fertilisation in the southern temperate rock lobster *Jasus edwardsii* (Hutton) (Decapoda: Palinuridae). *Journal of Experimental Marine Biology and Ecology* 120: 277-285.  
Experiments were carried out with newly moulted females to determine whether fertilisation is internal or external. The 'spermathecae' of experimental females were blocked with cement or mechanically. After mating, these females as well as controls extruded fertilised eggs, proving that fertilisation was external. Behavioural implications of external fertilisation are discussed.
- 211 McKENZIE, S. 1986: The Bay of Plenty rock lobster fishery. Economic appraisal 1982-1984. *N.Z. Fishing Industry Board Report EM 65*. 27 p.  
The Bay of Plenty fishery is described in terms of catch, effort, costs, and earnings, and a break-even analysis is conducted. Over the period studied, catches declined while effort increased, and the distribution of catches changed. Profitability increased because of increased landed values. The break-even analysis suggested that the number of vessels fishing should be reduced by half. Pot limits as an economic regulation are discussed.

- 212 McKOY, J.L. 1975: New tag aids rock lobster research. *Catch 2(1)*: 16.  
This describes what has become known as the Western Australia rock lobster tag.
- 213 McKOY, J.L. 1975: Gisborne rock lobster tagging programme. *Catch 2(10)*: 16.  
Results of this major study on growth, mortality, and movements, described here at its beginning, were published as Nos. 9, 10, 11, 15, 32, 33, 222.
- 214 McKOY, J.L. 1977: Rock lobster farming - an unlikely prospect. *Catch 4(6)*: 4-5.  
Problems with rock lobster culture are identified and discussed. The long larval stage and difficulties with rearing larvae successfully are a barrier to a complete culture system. Problems with rearing wild-caught juveniles are juvenile supply, slow growth rate, cost of food, and legal problems of marketing small product.
- 215 McKOY, J.L. 1979: Mating behaviour and egg laying in captive rock lobster, *Jasus edwardsii* (Crustacea: Decapoda: Palinuridae). *N.Z. Journal of Marine and Freshwater Research 13*: 407-413.  
Rock lobsters were kept in a glass-fronted aquarium and observed. Mating was observed up to 5 weeks after moulting, and egg-laying immediately after mating. The behaviours of mating and egg-laying are described and illustrated. External fertilisation with a short-lived spermatophore is suggested (see No. 210).
- 216 McKOY, J.L. 1979: An annotated bibliography of the New Zealand rock lobster *Jasus edwardsii* (Hutton). *Fisheries Research Division Occasional Publication No. 18*. 16 p.  
All 93 references are included in the present bibliography, some with the original annotation.
- 217 McKOY, J.L. 1980: Biological area studies: Stewart Island. *Catch 7(7)*: 29.  
A brief summary of growth, mortality, and movements of lobsters tagged at Stewart Island, based on the studies described fully in Nos. 220 and 221.
- 218 McKOY, J.L. 1981: Rock lobsters: handle with care. *Catch 8(1)*: 23-24.  
The article briefly summarises factors that affect survival of lobsters returned to the water (undersized and berried females). A code of handling practice is suggested which includes sorting as quickly as possible, returning lobsters to appropriate habitat, careful handling, and protecting lobsters from the wind, rain, and sun.
- 219 McKOY, J.L. 1982: Carapace trials to continue. *Catch 9(6)*: 15.  
A brief note describes continuation of carapace measurement trials in which fishermen were asked to compare the proposed carapace length with tail length.
- 220 McKOY, J.L. 1983: Movements of rock lobsters, *Jasus edwardsii* (Decapoda: Palinuridae), tagged near Stewart Island, New Zealand. *N.Z. Journal of Marine and Freshwater Research 17*: 357-366.  
About 4400 lobsters were tagged. Most were recovered close to the points of release, but some made large movements - one was recaptured in Milford Sound. All large movements were clockwise from the east coast of Stewart Island, then west towards Fiordland. Those lobsters making long movements were small males and immature females, and many had been identified as 'run' lobsters at tagging. Implications of large-scale migrations are discussed.
- 221 McKOY, J.L. 1985: Growth of tagged rock lobsters (*Jasus edwardsii*) near Stewart Island, New Zealand. *N.Z. Journal of Marine and Freshwater Research 19*: 457-466.  
From recaptures of tagged animals (the same tagging programme as

- No. 220) moult frequency, seasons, and size-specific moult increments are estimated. Size at maturity is estimated for females. Sexual differences in growth are apparent, and growth at Stewart Island is different from that at Gisborne.
- 222 McKOY, J.L., and ESTERMAN, D.B. 1981: Growth of rock lobsters (*Jasus edwardsii*) in the Gisborne region, New Zealand. *N.Z. Journal of Marine and Freshwater Research* 15: 121-136.  
Tagging was conducted in the Gisborne-Mahia area. From returns, growth increment - initial length relations were examined and moult frequency - initial size relations estimated. Juvenile growth rates were also estimated from modal size frequency shifts. Sexual and area differences were observed.
- 223 McKOY, J.L., and LEACHMAN, A. 1982: Aggregations of ovigerous female rock lobsters, *Jasus edwardsii* (Decapoda: Palinuridae). *N.Z. Journal of Marine and Freshwater Research* 16: 141-146.  
Diving observations are presented from several areas around New Zealand. Aggregations described contained a high proportion of large berried females, typically seen on open bottom in areas of strong water movement. Specific behaviour suggested to be defensive is described. The function of aggregations may be related to larval dispersal at hatching (see No. 208).
- 224 McKOY, J.L., and SANDERS, B.M. 1981: Rock lobster system working well. *Catch 8(10)*: 24.  
Catch and catch per vessel day are given for each of the 10 Controlled Fishery areas, 1979-80. The fishing return system that provides these data is described.
- 225 McKOY, J.L., and WILSON, C. 1980: Rock lobster feeding behaviour studied. *Catch 7(7)*: 23-24.  
Rock lobsters appear to feed mainly at night. The main items found in lobster stomachs were snails and other molluscs, crabs, sea urchins, and brittle stars.
- 226 McWILLIAM, P.S., and PHILLIPS, B.F. 1987: Distinguishing the phyllosoma larvae of rock lobster species of the genus *Jasus* (Decapoda, Palinuridae) in the waters of Australia and New Zealand. *Crustaceana (Leiden)* 52(1): 1-24.  
Characters which separate the phyllosoma larvae of *J. edwardsii*, *J. verreauxi*, and *J. novaehollandiae* are discussed. Good larval diagrams are provided.
- 227 MEYER-ROCHOW, V.B., and TIANG, K.M. 1981: Seeing lobsters are correctly treated. *Catch 8(3)*: 17-21.  
This article interprets results of a scientific paper (No. 228) concerning the effect of strong light on the rock lobster eye. This has relevance to handling sublegal and berried female lobsters before they are returned to the water. It is recommended that these be protected from sunlight as much as possible to prevent damage to the eyes.
- 228 MEYER-ROCHOW, V.B., and TIANG, K.M. 1984: The eye of *Jasus edwardsii* (Crustacea, Decapoda, Palinuridae): electrophysiology, histology, and behaviour. *Zoologica* 134: 1-58 + 24 plates.  
This paper describes the anatomy and physiology of the eye and its normal responses, light conditions in the natural habitat and aboard fishing vessels, lobster behaviour, and the effect of strong light. "Even brief exposures to very bright lights such as sunlight affect the rock lobster in a number of ways, all detrimental to survival." Effects of such damage, and their impacts on survival, are discussed.

- 229 MICHAEL, K., and BOOTH, J.D. 1985: Rock lobsters at the Auckland Islands. *Catch 12(5-9)*: 18.  
*J. edwardsii* were seen in dives at the Auckland Islands. Specimens from here were previously known from seal vomit (No. 310) and exploratory catches (No. 189). This is the southernmost limit of the species' range, and the southernmost limit for any rock lobster. The origin of rock lobsters found here is discussed.
- 230 MIERS, E.J. 1876: Catalogue of the stalk- and sessile-eyed Crustacea of New Zealand. Colonial Museum and Geological Survey Department, Wellington. 136 p.  
 Brief redescriptions of *Palinurus lalandii* Milne-Edwards and *P. edwardsii* Hutton are given. Differences between these species are discussed. The author doubts if *P. lalandii* occurs in New Zealand waters.
- 231 MOYLE, C. 1987: Tail width and tail at sea. *N.Z. Professional Fisherman 1(9)*: 14-15.  
 A brief article from the Minister of Fisheries outlines the Ministry proposal to replace the tail length size limit with the equivalent tail width measure (with separate measurements for males and females because of morphometric differences), to examine the morphometry of packhorse lobsters and then to make a similar change, to make the change for amateurs after an information programme, and to review the restrictions on tailing at sea. An accompanying comment from the Federation of Commercial Fishermen supports the proposal.
- 232 MORGAN, G.R. 1980: Population dynamics of spiny lobsters. In J.S. Cobb and B.F. Phillips (Eds.), "The Biology and Management of Lobsters. Vol. II: Ecology and Management", pp. 189-217. Academic Press, New York.  
*J. edwardsii* is included in this comprehensive review of the quantitative biology of the rock lobsters. Topics covered include stock identification, growth, mortality, reproductive biology, stock-recruit relations, and stock assessments.
- 233 NIK HUSAIN, N.R. bt. 1984: Studies on the subunit structure of four arthropod haemocyanins. Unpublished PhD thesis, Victoria University of Wellington, Wellington. 193 p.  
 Haemocyanin in *J. edwardsii* and *J. novaehollandiae* contained two heterogeneous subunits. Structure of the haemocyanin molecule is described. Effects of heavy metals on oxygen affinity and spectral properties are described.
- 234 PARKER, T.J. 1884: On the structure of the head in *Palinurus*, with especial reference to the classification of the genus. *Transactions and Proceedings of the N.Z. Institute 16*: 297-307.  
 The structure of the head of *Palinurus edwardsii* [*Jasus edwardsii*] is described and compared with that of *P. vulgaris* and *P. interruptus*. A reclassification of the subgenera of the family on the basis of the development of the rostrum and the presence or absence of a stridulating organ is proposed. The first use of the generic name *Jasus* occurs.
- 235 PARKER, T.J. 1887: Remarks on *Palinurus lalandii*, M. Edw., and *P. edwardsii*, Hutton. *Transactions and Proceedings of the N.Z. Institute 19*: 150-155.  
 Differences between *Palinurus edwardsii* [*Jasus edwardsii*] from New Zealand and *P. lalandii* from South Africa are discussed. The differences pointed out by Miers (1876; No. 230) are not apparent in a series of samples from both places, but consistent differences in the sculpturing of the abdomen lead the author to conclude that the name *P. edwardsii* should be retained for the New Zealand species, *P. lalandii* no longer being considered to occur in New Zealand.

- 236 PARKER, T.J. 1889: The skeleton of the New Zealand crayfishes (*Palinurus* and *Paranephrops*). *Studies in Biology for New Zealand Students, Colonial Museum and Geological Survey Department, Wellington* 4. 25 p.  
The general anatomy and terminology of the exoskeleton of *Palinurus [Jasus] edwardsii* are described, with a procedure for examination and dissection.
- 237 PAUL, L.J. 1979: A bibliography of the literature about New Zealand's marine and freshwater commercial fisheries 1840-1975. *Fisheries Research Bulletin No. 16*. 43 p.  
As well as a short bibliography of rock lobsters, this includes references to general reviews of New Zealand fisheries, economic aspects, and fisheries research. Well illustrated with photographs of historical interest.
- 238 PAYNE, D.A. 1985: New Zealand rock lobster resource management. Address to the International Seafood Conference, Marrakech, 20-23 October 1985. (Unpublished MS, held in Fisheries Research Centre library, Wellington.) History and current structure of the fishery are briefly described. Markets are described in conjunction with the form of exports. Live lobster export is described, and the effect of the \$NZ exchange rate is discussed.
- 239 PETERSON, G. 1986: Second round for rock lobster ITQ proposals. *Catch 13(10)*: 5.  
A brief outline of the state of consultations between MAF and the industry at November 1986. The revised proposal for transferable quotas (No. 80) is summarised.
- 240 PHILLIPS, B.F., COBB, J.S., and GEORGE, R.W. 1980: General biology. In J.S. Cobb and B.F. Phillips (Eds.), "The Biology and Management of Lobsters. Vol. I, Physiology and Behaviour", pp. 2-82. Academic Press, New York.  
*J. edwardsii* is included in this general review of lobster biology.
- 241 PHILLIPS, B.F., and McWILLIAM, P.S. 1986: The pelagic phase of spiny lobster development. *Canadian Journal of Fisheries and Aquatic Sciences* 43: 2153-2163.  
A review of information on pre-settled rock lobsters with reference to oceanic and vertical water movement patterns. The possibility of natural transport of larval Australian rock lobsters to New Zealand is discussed.
- 242 PIKE, R.B. 1966: Crayfish. In A.H. McLintock, (Ed.), "An Encyclopaedia of New Zealand", Vol. 1, pp. 405-406. Government Printer, Wellington.  
A brief description of the species, habitat, distribution, size at first maturity, life history, and growth of both New Zealand species of *Jasus*.
- 243 PIKE, R.B. 1969: A case study in research: crayfish. In E.B. Slack (Ed.), "Fisheries and New Zealand", pp. 95-107. Department of University Extension, Victoria University of Wellington, Wellington.  
A review of the results of research on the rock lobster fishery carried out between 1961 and 1963, based on the same data presented in Kaberry and Pike (1967; No. 184).
- 244 PIKE, R.W., and SLACK, E.B. [undated]: The New Zealand crayfish or spiny lobster *Jasus edwardsii* (Hutton). The influence of temperature on survival times out of water. 7 p. (Unpublished report for the Standards Association of New Zealand, held in Fisheries Research Centre library, Wellington.)  
A report on experiments carried out in 1967. There was no significant difference in survival time of lobsters kept in wet and dry sacks. Rock



- lobsters held for less than 36 hours should be kept at less than 15°C; if processing is up to 48 hours after catching, they should be held at between 5 and 8°C.
- 245 POWELL, A.W.B. 1947: Native animals of New Zealand. Auckland Museum Handbook of Zoology. Unity Press, Auckland. 96 p.  
A brief general description of *J. edwardsii*, then considered *J. lalandii*. In George Sound "they were so numerous that pots were almost filled after being down but a few minutes, and the shore was littered with the cast shells."
- 246 POWELL, P. 1976: "Fishermen of Fiordland." A.H. and A. W. Reed, Wellington. 118 p.  
A popular account of rock lobster fishing in Fiordland; well illustrated with photographs.
- 247 PROVENZANO, A.J. 1985: Commercial culture of decapod crustaceans. In A.J. Provenzano (Ed.), "The Biology of Crustacea, Vol. 10, Economic Aspects: Fisheries and Culture", pp. 269-314. Academic Press, New York. *J. edwardsii* is mentioned in this review of lobster culture.
- 248 RILEY, P. 1980: Economic aspects of New Zealand's policies on limited entry fisheries. *Research Paper, Economics Division, N.Z. Ministry of Agriculture and Fisheries, 2/80*. 18 p.  
The history of restrictions on entry to New Zealand fisheries is discussed, followed by detailed analysis of the impacts on oysters, scallops, and eels. Possible effects of limited entry, then newly imposed on the rock lobster fishery, are discussed. The importance of clearly stated economic goals is emphasised.
- 249 RITCHIE, L.D. 1966: Crayfish pot escape gap survey November 1965 - January 1966. *Fisheries Technical Report No. 14*. 23 p.  
A survey carried out at Gisborne, Napier, Wellington, and Bluff in 1965-66 with a variety of pot types showed that escape gaps in rock lobster pots effectively reduce the catch of undersized rock lobsters, but maintain the catch of legal-sized animals.
- 250 RITCHIE, L.D. 1971: Lobster pot escape gaps: are they effective? *Commercial Fishing 10(2)*: 23-24.  
A popular condensation of No. 249. A table shows that octopus visit pots without escape gaps more frequently than pots with gaps, but that octopus are caught more frequently by pots without escape gaps. A second table shows the effect of escape gaps on legal and sub-legal catch rates.
- 251 RITCHIE, L.D. 1972: Octopus predation on pot-caught rock lobster, Hokianga area, New Zealand. *Fisheries Technical Report No. 81*. 44 p.  
During the survey period the level of octopus predation at Hokianga was severe. Escape gaps did not increase the incidence of octopus predation, but pots with escape gaps retained smaller numbers of preying octopus than those without.
- 252 ROBINSON, H.A., and ELLERTON, H.D. 1977: Heterogeneous subunits of the hemocyanins from *Jasus edwardsii* and *Ovalipes catharus*. In J.V. Bannister (Ed.), "Structure and Function of Haemocyanin", pp. 55-70. Springer-Verlag, Berlin.  
Evidence for heterogeneity of the subunits of haemocyanin from *J. edwardsii* is presented and the properties of the subunits are described (see Nos. 167, 168, 169).
- 253 ROSENSTREICH, A.A. 1983: Rock lobsters. *Catch 10(1)*: 21.  
This letter from a meat inspector continued the controversy (see No. 268) about quality in lobster tails frozen at sea. He suggested that vessels able to land live product should do so, and that other vessels in the tailing-at-sea area should upgrade their equipment.

- 254 SAILA, S.B., ANNALA, J.H., MCKOY, J.L., and BOOTH, J.D. 1979: Application of yield models to the New Zealand rock lobster fishery. *N.Z. Journal of Marine and Freshwater Research* 13: 1-11. This paper presents the first major stock assessment for this species. From a Fox surplus-production analysis of catch and effort (based on vessels) from the North and South Islands combined, maximum sustainable yield was estimated to be 4227 t (at 784 vessels effort). Yield-per-recruit was calculated using growth data from the Gisborne area. Two growth models produced different results, and the authors prefer an empirical growth description over the von Bertalanffy. Yields at 1978 fishing mortality rates and minimum legal size were only slightly less than optimum yields, but the authors point out the need for further data from other areas.
- 255 SAILA, S.B., WIGBOUT, M., and LERMIT, R.J. 1980: Comparison of some time series models for the analysis of fisheries data. *Journal du Conseil International pour l'Exploration de la Mer* 39(1): 44-52. Three time series models were used on a 12-year series of monthly mean catch-per-day data from the Gisborne fishery. The best results were obtained with an auto-regressive integrated moving average.
- 256 SANDERS, B.M. 1983: The 1981 New Zealand rock lobster landings. *Fisheries Research Division Occasional Publication: Data Series No. 12*. 31 p. See No. 260.
- 257 SANDERS, B.M. 1983: The 1982 New Zealand rock lobster landings. *Fisheries Research Division Occasional Publication: Data Series No. 13*. 31 p. See No. 260.
- 258 SANDERS, B.M. 1984: The 1983 New Zealand rock lobster landings. *Fisheries Research Division Occasional Publication: Data Series No. 16*. 31 p. See No. 260.
- 259 SANDERS, B.M. 1985: The 1984 New Zealand rock lobster landings. *Fisheries Research Division Occasional Publication: Data Series No. 23*. 32 p. See No. 260.
- 260 SANDERS, B.M. 1986: The 1985 New Zealand rock lobster landings. *Fisheries Research Division Occasional Publication: Data Series No. 29*. 31 p. Reported landings and effort (vessel-days and pot-lifts) of *J. edwardsii* are tabulated by month for 42 rock lobster statistical areas, and by month for each of the 10 Controlled Fishery areas. Total landings for both *Jasus* species are given for each port of landing. Distribution of catch among vessels is given for each Controlled Fishery area.
- 261 SANDERS, B.M. 1988: The 1986 New Zealand rock lobster landings. *New Zealand Fisheries Data Report No. 32*. 31 p. See No. 260.
- 262 SANDERS, B.M., and ANNALA, J.H. 1982: 1981 preliminary rock lobster landings. *Catch* 9(5): 27. A popular summary of the data in No. 256.
- 263 SANDERS, B.M., and ANNALA, J.H. 1983: Rock lobster landings constant. *Catch* 10(5): 27. A popular summary of the data in No. 257.

- 264 SANDERS, B.M., MCKOY, J.L., and ANNALA, J.H. 1982: The 1980 New Zealand rock lobster landings. *Fisheries Research Division Occasional Publication: Data Series No. 9*. 32 p.  
See No. 260.
- 265 SCALLY, K.B., EVERY, R.G., and TUNNICLIFFE, G.A. 1974: Thegosis in the red spiny lobster *Jasus edwardsii* (Crustacea: Decapoda: Palinuridae). *Journal of Dental Research* 53: 709.  
Mandibles of intermoult *J. edwardsii* were compared with those of rock lobsters starved and isolated after the moult. (Thegosis is tooth grinding.) (See also No. 298.)
- 266 SCOTT, W.J. (Chairman) 1962: Fishing Industry Committee 1962. *Appendix to the Journals of the House of Representatives of N.Z., I*. 19. 87 p.  
A review of evidence given to the committee on rock lobsters is included and recommendations are made on tailing at sea, measurement of rock lobsters, size limits, and ports of landing.
- 267 SKINNER, B.E. 1980: A view from Stewart Island. *Catch* 7(8): 14-16.  
This article represents the views of the Stewart Island Fishermen's Association on a variety of issues. New regulations proposed by the MAF Meat Division for handling of rock lobsters tailed at sea were seen as unnecessary and impractical.
- 268 SKINNER, B.E. 1982: Rock lobster issue. *Catch* 9(9): 25-26.  
This letter presents reaction to new freezing regulations developed by the MAF Meat Division for maintaining the quality of tails removed at sea (cf. No. 253).
- 269 SLARK, M. 1985: The Kaikoura rock lobster fishery: An evaluation of the fishery and future management options. Unpublished MSc thesis, Centre for Resource Management, University of Canterbury, Christchurch. 135 p.  
Focuses on the Kaikoura area, but includes an analysis of the lobster fishery in New Zealand as a whole. The local fishery is described in terms of biology, economics, and sociology. Management options are described and discussed, with emphasis on pot limits and individual transferable quotas (ITQs). ITQs were seen as the best solution to current problems in this fishery.
- 270 SMITH, P.J., and MCKOY, J.L. 1978: Low levels of genic heterozygosity in *Jasus edwardsii*. *Isozyme Bulletin* 11: 68.  
Screening for 15 enzymes in samples from Stewart Island and Gisborne produced only one useful polymorphic locus. No differences in allele frequencies were apparent between the two areas.
- 271 SMITH, P.J., and MCKOY, J.L. 1980: N.Z. rock lobsters one stock. *Catch* 7(7): 31.  
A popular summary of No. 270.
- 272 SMITH, P.J., MCKOY, J.L., and MACHIN, P.J. 1980: Genetic variation in the rock lobsters *Jasus edwardsii* and *Jasus novaehollandiae*. *N.Z. Journal of Marine and Freshwater Research* 14: 55-63.  
*J. edwardsii* were sampled from Gisborne, Wellington, and Stewart Island. Genetic variation between these sites was so low that the authors suggest lobsters from these areas are of a single stock. Variation between *J. edwardsii* and *J. novaehollandiae* was slightly greater, but the authors suggest the two species are the same.
- 273 SMOLOWITZ, R.J. 1978: An annotated bibliography on lobster trapping and related subjects. *Marine Fisheries Review* 40(5-6): 68-77.  
A worldwide literature survey. Related subjects include ghost fishing.

- 274 SORENSON, J.H. 1969: The New Zealand rock lobster or marine spiny crayfish *Jasus edwardsii* (Hutton). Distribution, embryology, and development. *Fisheries Technical Report No. 29*. 46 p.  
A general review of the distribution, sexual dimorphism, reproductive biology, life history, growth, and laboratory rearing of *J. edwardsii*. An account of the problem of "scrubbing" eggs from berried females is also included.
- 275 SORENSON, J.H. 1970: New Zealand rock lobster *Jasus edwardsii* carapace and tail measurements. *Fisheries Technical Report No. 53*. 32 p.  
A history of the regulations relating to measurement of rock lobsters in New Zealand. The use of carapace measures is discussed. Data on the relationship between carapace, tail, and total length are presented.
- 276 SORENSON, J.H. 1971: History of rock lobster measuring in New Zealand. *Commercial Fishing 10(2)*: 8-12.  
Subtitled "35 years of ups and downs in minimum legal length". After giving the history of size regulations, Sorenson describes the advantages of carapace length as a measure, discusses how carapace length might be defined and measured, and summarises work carried out to determine the appropriate carapace length equivalent to the tail length. For recent developments see No. 87.
- 277 STANDARDS ASSOCIATION OF NEW ZEALAND. 1970: Specification for the processing, storage, and transportation of fresh and frozen rock lobsters and frozen rock lobster tails. *N.Z. Standard 2227*: 1970.  
Standards are defined for handling of rock lobsters on fishing vessels, at unloading points, during transportation, in processing establishments, and during packaging, marketing, and retailing. Superseded by *N.Z. Standard 8406*: 1975 (No. 278).
- 278 STANDARDS ASSOCIATION OF NEW ZEALAND. 1975: Code of practice for the handling, processing, storage, and distribution of fresh and frozen rock lobsters and frozen rock lobster tails. *N.Z. Standard 8406*: 1975. 20 p.  
Supersedes *N.Z.S. 2227*: 1970 (No. 277). At date of writing, this was still the current Standard.
- 279 STEAD, D.H. 1973: Rock lobster salinity tolerance. *Fisheries Technical Report No. 122*. 10 p.  
Experiments on the tolerance of rock lobsters to sudden changes in salinity showed increasing mortality after a 7 parts per thousand differential, but rock lobsters became acclimatised if the differential was less than 3 ppt. On the basis of these experiments the use of "live well" boats in the Fiordland area was not considered feasible because of low-salinity surface waters in the area.
- 280 STEWART, L.B., FLEMING, J.S., and ELLERTON, H.D. 1973: Physical studies on the haemocyanin from *Jasus lalandii*. *Proceedings of the Australian Biochemical Society 6*: 23.  
Haemocyanin from *J. edwardsii* was studied with various physico-biochemical techniques.
- 281 STREET, R.J. 1966: Experiments with escape gaps in crayfish pots. *Commercial Fishing 4(9)*: 10-11.  
In Otago and Foveaux Strait pots with escape gaps retained fewer undersized rock lobsters than those without escape gaps.
- 282 STREET, R.J. 1969: New Zealand marine crayfish. In J. Pollard (Ed.), "Australian and New Zealand Fishing", pp. 172-176. Paul Hamlyn, London.  
A brief description of the distribution, fishery, life history, habitat, behaviour, reproduction, growth, moulting, and migrations of *J. edwardsii*.

- 283 STREET, R.J. 1969: The New Zealand crayfish *Jasus edwardsii* (Hutton). *Fisheries Technical Report No. 30*. 53 p.  
Work carried out around the southern South Island on growth, moulting, movements, reproductive biology, and predators is described. Data on relations between total length, carapace length, and tail length are presented.
- 284 STREET, R.J. 1970: New Zealand rock lobster *Jasus edwardsii* (Hutton) South Island fisheries. *Fisheries Technical Report No. 54*. 63 p.  
A summary from log books of catches and catch per unit of effort (where effort is in units of boats, days, and sometimes pot lifts) and size composition of catches in areas ranging from Otago to Fiordland. Estimates of fishing intensity are made based on tagging at Karitane and Foveaux Strait. Discussion of management measures in the New Zealand fishery covers size limits, protection of berried females and soft shell animals, closed seasons and areas, gear limitations, processing at sea, and licence limitation.
- 285 STREET, R.J. 1971: Rock lobster migration off Otago. *Commercial Fishing 10(6)*: 16-17.  
Migrations of rock lobsters from Otago to Foveaux Strait as determined from tagging and trawlermen's catches are reported. The movement took place in 45-65 m depth at an average speed of 5-7 km per day.
- 286 STREET, R.J. 1973: Trends in the rock lobster fishery in southern New Zealand, 1970-1971. *Fisheries Technical Report No. 116*. 32 p.  
Landings and size composition of rock lobsters from Otago, Foveaux Strait, and Fiordland for 1970-71 are recorded. Observations from tagging in these areas include data on growth rates and patterns of migration. Size limit changes in the Otago fishery are discussed.
- 287 STREET, R.J. 1973: The Otago rock lobster fishery 1972 season. *Fisheries Technical Report No. 125*. 22 p.  
Landings and size composition data for Otago ports during 1972 are compared with those from previous years. Catches were substantially lower than in 1971, mainly because of an increase in the size limit.
- 288 STREET, R.J. 1980: Southern rock lobster research. *Catch 7(9)*: 25-27.  
Information on growth and migrations in Otago and the Southern area are summarised. (See Nos. 283, 284, 286.)
- 289 STREET, R.J. 1982: Rock lobsters down in Otago. *Catch 9(9)*: 29.  
Declines in Otago landings in 1980 and 1981 may have been caused by high juvenile mortalities in June 1980, in turn caused by freshwater flooding after heavy rains.
- 290 STREET, R.J., and BOOTH, J.D. 1985: Prospects for the Otago rock lobster fishery. *Catch 12(3)*: 14-16.  
Fluctuations in the Otago catch are described. Results of puerulus settlement on collectors and of diving and pot sampling studies are described. Based on this information plus movement patterns and a knowledge of environmental events, the authors predict improved catches for 1985. For 1986, puerulus sampling and juvenile surveys give conflicting results. (As it turned out, Otago catches increased in 1985 and decreased slightly in 1986.)
- 291 SUMNER, J.L., BOYD, N.S., and WILSON, N.D. 1972: Processing of N.Z. rock lobster: 1. Bacteriological quality. *Commercial Fishing (N.Z.) 11(11)*: 15-17.  
Bacterial levels in rock lobster tails from tailing-at-sea areas and tailing-on-land areas were investigated and compared. The authors conclude that tailing at sea does not lead to an inferior product

- compared with tailing on land; but that if standards were imposed, 60% of all tails would be rejected irrespective of which tailing procedure was used.
- 292 TARRING, S. 1980: Egg development studies. *Catch 7(7)*: 21.  
A brief description of the reproductive cycle between mating and egg hatching is accompanied by micrographs showing egg development.
- 293 THOMAS, J. 1969: Some spoilage changes of fresh New Zealand crayfish tails (*Jasus lalandei*). *Food Technology in N.Z.* 4: 139, 141.  
Whole rock lobsters were iced and examined for changes in total viable bacteria counts and levels of trimethylamine nitrogen in the tail meat over 15 days. Iced storage is recommended to be limited to 5 days.
- 294 THOMPSON, J. 1963: Devastating cray tail proposal would cripple coast fishing, causing chaos and ruin. *Commercial Fishing 2(4)*: 4.  
This article and No. 38 were written in reaction to a Parliamentary Committee's recommendation that tailing at sea be abolished. The title is suggestive of the substance of the arguments made.
- 295 THOMSON, G.M. 1907: Note on the development of *Palinurus edwardsii*. *Transactions and Proceedings of the N.Z. Institute* 39: 484-485.  
The naupliosoma and first stage phyllosoma of *J. edwardsii* are described.
- 296 THORN, J. (Chairman). 1939: Report of the New Zealand Sea Fisheries Investigation Committee 1937-38. *Appendix to the Journals of the House of Representatives of N.Z., H.-44A*. 128 p.  
Information on stocks of rock lobsters, the general state of the fishery, catch composition, and catching methods for several areas around New Zealand. Recommendations include a legal size of 9 inches (229 mm) total length; prohibition of taking or selling berried females or removing ova from them; strict controls on set-net fishing for rock lobsters.
- 297 TIANG, K.M. 1982: The effects of light on visual performance and structural organisation of the eye of the New Zealand rock lobster *Jasus edwardsii* (Palinuridae: Decapoda: Crustacea). Unpublished MPhil thesis, University of Waikato, Hamilton. 184 p.  
Describes the structure and physiology of the rock lobster eye and experiments on the effects of strong light. Some of these are summarised in No. 227. Bright light causes a great decrease in sensitivity of the eye and impairs light adaptation mechanisms. Unequal exposure to strong light results in stance and motion difficulties.
- 298 TUNNICLIFFE, G.A., EVERY, R.G., and SCALLY, K.B. 1974:  
Audiospectrographic analysis and behavioural significance of thegotic sounds. *Journal of Dental Research* 53: 710.  
Audiospectrographs of starved *J. edwardsii* are compared with those produced by other animals. (See also No. 265.)
- 299 TYSON, P.J., BREEN, P.A., and BOOTH, J.D. 1988: Juvenile red rock lobster sampling at Stewart Island. *Catch 15(2)*: 6-8.  
Studies relating puerulus abundance and juvenile abundance at Stewart Island are described. Puerulus settlement has been measured on collectors at Halfmoon Bay since 1980, and divers have examined populations of juveniles since 1982. A catch sampling programme to measure recruitment to the fishery began in 1987.
- 300 VOLLER, R.W. 1983: Fisheries resources of the Southland Region and their management. N.Z. Ministry of Agriculture and Fisheries, Dunedin. 47 p. (Unpublished report, held in Fisheries Research Centre library, Wellington.)  
This regional review gives rock lobster landings and effort by local areas, and describes the rock lobster fisheries of the Southland Region.

- 301 WAITE, E.R. 1909: Scientific results of the New Zealand Government Trawling Expedition, 1907. Government Printer, Wellington. 127 p. In 1907 the new Napier trawler *Nora Niven* was chartered for 6 months of exploratory trawling around New Zealand. This volume describes the two voyages and includes taxonomic treatments of the algae, annelids, sipunculids, echinoderms, and fishes. Passing mention is made of large catches of rock lobsters. At Pitt Island, "Enormous bags of ... crayfish (*Jasus edwardsi*) were taken in Petre and Hanson Bays." A photograph is shown of swimming crabs and rock lobsters at the Chatham Islands. "Every haul made at the islands produced enormous bags of these crustaceans, and, as a result, sacksful of crayfish were handed to the Maories and Morioris, who regard them as special delicacies."
- 302 WALSH, P.L. 1964: A study of some aspects of sensory physiology and behaviour of the crayfish, *Jasus edwardsii*. Unpublished BSc (Hons) thesis, University of Otago, Dunedin. 51 p. Observations on the behaviour of *J. edwardsii* were made in tanks and by skin-diving. Tank experiments determined the responses of individual animals to different stimuli and the relative sensitivity of various parts of the body. External and internal structure of the antennules are described and the function of the antennule in relation to general activities is discussed.
- 303 WALSH, K.A., and CLEMENT, I.T. 1987: MAF proposals for future rock lobster fisheries management discussed around the country. *Catch 14(1)*: 4-5. This article describes issues raised during a series of industry meetings held in early 1987 to discuss the management proposals described in No. 79.
- 304 WATKINSON, J.G., and SMITH, R. (Comps.) 1972: "New Zealand Fisheries." N.Z. Marine Department, Wellington. 91 p. This includes a brief review of the landings, fishing areas, fishing methods, and development of the rock lobster fishery.
- 305 WAUGH, G.D. 1969: Changes in catch per unit effort. Appendix D to Appendix B, In "Report of the Fisheries Committee to the National Development Conference", pp. 89-96. Reported landings of both rock lobster species per vessel day are reported for three vessel size classes and for each of the statistical areas operative at that time.
- 306 WAUGH, G.D. 1973: Fish and fisheries. In G.R. Williams (Ed.), "The Natural History of New Zealand", pp. 251-284. A.H. & A.W. Reed, Wellington. Taxonomy of the genus *Jasus* and biological studies on *J. edwardsii* are reviewed. The fishery, particularly the Chatham Islands boom of the 1960s, is described, and landing patterns around the country are illustrated.
- 307 WEAR, R.G. 1979: The future for crustaceans. *Catch 6(10)*: 32-34. Potential for commercial aquaculture of *J. edwardsii* is discussed along with other crustacean species. Wear "would again discourage any efforts to culture [*J. edwardsii*] from the egg through to marketable size ..." because of the long larval life, slow growth rate of juveniles, and demanding conditions for growing out. Growing rock lobsters in warm water effluent and sale at 150 mm total length might be feasible.
- 308 WEEBER, B. 1987: Rock lobster industry has its say. *Catch 14(3)*: 17. This describes a poll of rock lobster fishermen and industry workers to gauge support for two major management options - continuation of the Controlled Fishery but with an overall total allowable catch, and ITQs. The poll was organised by the N.Z. Fishing Industry Board.

- 309 WILLIAMSON, D.I. 1967: Some recent advances and outstanding problems in the study of the larval Crustacea. In "Proceedings of the Symposium on Crustacea, Part II", pp. 815-823. Marine Biological Society of India. Possible larval recruitment to New Zealand from Australia is discussed for both *J. edwardsii* and *J. verreauxi*. Artificial rearing of *J. edwardsii* and *J. novaehollandiae*, and studies of phyllosoma distribution in mid-Tasman, could be valuable in understanding whether or not significant numbers of *J. edwardsii* originate in Australia.
- 310 YALDWYN, J.C. 1958: Decapod Crustacea from Subantarctic seal and shag stomachs. *Records of the Dominion Museum (N.Z.)* 3(2): 121-127. The presence of *Jasus lalandei frontalis* [*J. edwardsii*] is recorded at the Snares Islands and from a seal stomach at the Auckland Islands. The distribution of this species in southern New Zealand and the subantarctic islands is briefly discussed.
- 311 YALDWYN, J.C. 1965: Antarctic and Subantarctic decapod Crustacea. *Monographiae Biologicae* 15: 324-332. *J. edwardsii* from the Snares Islands are considered to be the southernmost record for spiny lobsters, although a specimen was also reported in seal vomit from the Auckland Islands (No. 310). (See also No. 229.)
- 312 YOUNG, M.W. 1923: The fishing industry of the Chatham Islands. *N.Z. Journal of Science and Technology* 6: 50-53. "Crayfish - at the present time these are not worth troubling about; but if trawling is ever started at the Chathams they would be well worth canning, as they are present in great numbers."
- 313 YOUNG, M.W. 1926: Marine biological notes: No. 2. Growth of crayfish in captivity. *N.Z. Journal of Science and Technology* 8: 282-283. A small *J. edwardsii* captured in May 1921 grew from 4.2 to 14.0 cm total length during 3.5 years in captivity at the Portobello Marine Biological Station.
- 314 YOUNG, M.W. 1929: Marine fauna of the Chatham Islands. *Transactions and Proceedings of the N.Z. Institute* 60: 136-166. Lobsters are reported at the Chatham Islands in "great quantities" and stomachs of blue cod contained "large numbers of medium-sized specimens."



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