ANNOTATED REFERENCES TO TECHNIQUES CAPABLE OF ASSESSING THE ROLES OF CEPHALOPODS IN THE EASTERN TROPICAL PACIFIC OCEAN, WITH EMPHASIS ON PELAGIC SQUIDS

John B. Hedgepeth

NOAA-TM-NMFS-SWFC-39

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Center
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## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>LITERATURE CITED</td>
<td>2</td>
</tr>
<tr>
<td>ANNOTATED BIBLIOGRAPHY</td>
<td>3</td>
</tr>
<tr>
<td>TAXA INDEX</td>
<td>56</td>
</tr>
<tr>
<td>SUBJECT INDEX</td>
<td>65</td>
</tr>
</tbody>
</table>
INTRODUCTION

This annotated bibliography presents a list of publications relevant to pelagic cephalopod assessment, especially the assessment of epipelagic squids, in the eastern tropical Pacific Ocean (ETP). Pelagic cephalopods are important both to commercial fisheries (Voss 1973) and in their influences within oceanic ecosystems. In particular, epipelagic squids are found in stomachs of seabirds, fishes and marine mammals; and, squid are active predators of fishes, crustaceans and other marine organisms.

Two criteria were used for selection of articles. Articles concerning cephalopods were of primary interest. And because many of these animals have a cosmopolitan distribution, articles have been selected from worldwide sources. The second criterion was presentation of assessment techniques applicable to ETP cephalopods. Selection was not confined to methods which have been used solely within the ETP.

I have reviewed each article as thoroughly as time has permitted, and have compiled a summary of the article and a list of key words for each reference. I considered a wide variety of subjects to be relevant to the topic of assessment. Some pertinent subjects were capture gear and techniques, stock differentiation, trophic dynamics, identification of species, population modelling, growth and reproduction, distribution, and other censusing methods.

The references were entered into a microcomputer disk storage, using a format for a database program, Superfile (FYI 1982). This program is able to access publications and summarized information by using key words. In the future, as new papers are identified, this database will be updated.

There are about 500 key words which reference approximately 200 entries. Key words were selected to index publications by author, taxon and information type (such as gear type, ocean, etc.). Taxa used were family, genus and species. Species names use only the first initial of the genus. More complete species names are found in the index.

As an aid in locating articles by subject, each publication was placed into one of seven general categories, which are as follows:

1) Keys to identification
2) Summaries and surveys
3) Squid as prey for marine organisms
4) Commercial fisheries
5) Gear
6) Biology
7) Assessment techniques and population modelling

Accompanying each citation in the annotated bibliography is the number, between one and seven, which refers to one of the above general categories. These number codes follow a "*" at the beginning of the key words section of every citation.

Annotations summarize information relevant to cephalopod assessment in the ETP. As a result, sometimes the annotations are not summaries of the entire publication. In addition, key words may not represent all information mentioned by a publication. However, this annotated bibliography should allow workers in fields which deal with cephalopods to easily identify the relevant articles.

LITERATURE CITED


Comparisons of allelic variation, using the enzyme phosphoglucomutase. There was no conclusive evidence of stock discrimination.


Description of two specimens of Allopsus mollis captured off Southern California. A. mollis is found in tropical and subtropical waters, and has a cosmopolitan distribution. This cephalopod was observed actively avoiding capture.


A tuna feeding habits study from fish supplied by canneries and caught by both bait boats and purse-seiners. Yellowfin prey were by volume: fish (47%), crustaceans (45%) and cephalopods (8%), by occurrence: crustaceans (76%), fish (54%) and cephalopods (33%). Skipjack food items were by volume: crustaceans (59%), fish (37%) and cephalopods (3%), by occurrence: crustaceans (76%), fish (36%) and cephalopods (13%). Onychoteuthids, ommastrephids and unidentified squid were the main squid food of yellowfin. However, skipjack fed primarily on enoploteuthids and cranchids.


An experiment utilizing incandescent lights and mercury vapor lamps to capture longfinned squid, Loligo pealei. Squid congregated in the periphery of illumination but catches by jigging were poor except on one occasion. Netting of squid proved unsuccessful due to the erratic behavior of the squid.

Suggests methods for setting sounder controls (time varied gain, swept time constant, and pulse duration). Squid aggregations appeared as plumes or stripes, depending on settings and vessel movement.


A description of squid jiggling operations. Lighting, jiggling speed, line size, parachute anchoring, vessel construction and other areas discussed.


Summary of workshop on cephalopod biology and resources, dealing primarily with Australian applications. Topics included were taxonomy, ecology, biology, fisheries biology and assessment. Report states gill net fishing is three times more efficient than jiggling.


A summary of six talks on squid fisheries and resources in the Pacific Ocean. Fisheries mentioned were off California, Hawaii, Peru and Japan. Sea bird stomach samples, gonad evaluations, jiggling, trawling, and gillnetting provided assessment information on Hawaiian squids.

A short description of drift gillnet fishing for Ommastrephes bartramii by Japanese vessels. History, operation and regulation of the fishery are discussed.

*4 PACIFIC / FISHING / GILLNET / JIGGING / DISTRIBUTION / SEASONAL / O BARTRAMII


Japanese newspaper account of interactions within the squid drift gillnetting fleet. Gillnetters wanted to move west of a 170°E regulatory limit and into the fishery exploited by squid jigging vessels. Korean and Taiwanese gillnetters sometimes set nets contrary to the east-west Japanese deployment. Also, non-Japanese vessels were not restricted by the 170°E demarcation.

*4 GILLNET / JIGGING / PACIFIC / FISHING


A summary of squid fisheries and biology with numerous references to pertinent literature. Subjects discussed are systematics, biology, distribution, fisheries, fishing techniques, marketing, management and resource potential.

*2 ARNOLD G P / WORLDWIDE / TRAWL / NET / JIGGING / LIGHTS / PUMP / LAMPARA FISHING / ASSESSMENT / DISTRIBUTION / REPRODUCTION / SEASONAL / GROWTH / VERTICAL / SQUID DIET / FEEDING HABITS / MARINE MAMMALS / PACIFIC / ATLANTIC / EASTPACIFIC / ETP / MEDITERRANEAN / SEABIRDS / FISH


A proposal to show variations in surface fauna by capture and analysis of regurgitations of sea birds. The diet of four species of sea birds consisted mainly of flying fish, juvenile scombrids and ommastrephid squids. Comparisons showed that sea birds sample some food groups more efficiently than do trawls or yellowfin tuna.

*3 ASHMOLE N P / ASHMOLE M J / SEASONAL / SEABIRDS / PACIFIC / ASSESSMENT / OMMASTREPHIDAE / ENOPLOTEUTHIDAE / FISH / FEEDING HABITS / TRAWL


A description of feeding habits of five tern species found on Christmas Island. Differences in prey composition are related to feeding patterns
and anatomical structure of tern species.

*3 ASHMOLE N P / SEABIRDS / PACIFIC / FEEDING HABITS


Report of 1963-1964 food habits survey of 8 seabird species using 800 samples collected on Christmas Island. Frequency of occurrence of fish varied 45%-97%, and of squid 34%-97%. Nearly all squid were ommastrephids, Symplectoteuthis spp. Comparisons were made with stomach contents observations of 191 surface caught yellowfin (from Reintjes and King 1953).

*3 ASHMOLE N P / ASHMOLE M J / PACIFIC / SEABIRDS / FEEDING HABITS / FISH / SYMPLECTOTEUTHIS / LOLIGO / ABRALIA / OMMASTREPHIDAE / OCTOPoda


A review of the history of the fishery, population assessment, biology, and research dealing with the Atlantic Ocean ommastrephid squid, Illex illecebrosus. Includes 23 papers.

*2 BALCH N T / AMARATUNGA T / ODO R R K / ATLANTIC / I ILLECEBROSUS / ASSESSMENT / FISHING / IDENTIFICATION / REPRODUCTION / JIGGING / DISTRIBUTION / MODEL / TRAWL / T PACIFICUS


Extensions of a simple predator-prey model to multispecies approaches: krill-squid-sperm whales, krill-penguins-baleen whales. In the multispecies approach, both krill and sperm whales cannot sustain harvest based on individual maximum sustainable yields.

*7 BEDDINGTON J R / MAY R M / MODEL / MARINE MAMMALS / FEEDING HABITS / SQUID DIET


Article which suggests that Antarctic krill surplus, available after whale stock depletion, has contributed to increases of populations of remaining baleen whales, seals, penguins, sea birds, fishes and squid. Contrasting with smoother patterns of change in whale populations, fishes and squids of the Gulf of Thailand show substantial fluctuations, because fish have high mortality rates and few age classes.

*6 BEDDINGTON J R / MAY R M / FEEDING HABITS / MARINE MAMMALS / SEABIRDS / FISH / SQUID DIET / ANTARCTIC / INDIAN

Report of abundances of cephalopod beaks from collections made in the Indian and Pacific Oceans (1954-1961). Because squid beaks are not preserved for very long, rostra represent recent species. Densities (which were up to several thousand beaks per square meter) allow comparative quantification of squid resources. Results show untapped squid resources in coastal areas of the Indian Ocean.

*7 BELYAYEV G M / ASSESSMENT / DREDGE / DISTRIBUTION / G FABRICII / G MAGISTER / OCTOPODOTEUTHS / ARCHITEUTHS / T PAVO / HISTIOTEUTHIDAE / INDIAN / PACIFIC / EASTPACIFIC / DISTRIBUTION / A MOLLIS / MARINE MAMMALS FEEDING HABITS


A history and review of fishing with light, with a worldwide coverage. Lighting and fishing gear are described for squid fishing, as well as for other species such as herring, anchovy, mackerel, saury, kilka and sardinella.

*5 BEN-YAMI M / WORLDWIDE / PUMP / LIGHTS / JIGGING / PACIFIC / EASTPACIFIC FISHING


Review of fishing gear, processing, biology and identification. Exploratory fishing during fall 1979 by two Japanese research vessels, in conjunction with the Canadian government, is reported.

*7 BERNARD F R / EASTPACIFIC / L OPALESCENS / O BOREALIJAPONICUS / O BARTRAMII / B MAGISTER / JIGGING / LIGHTS / SONAR / NET / GILLNET / IDENTIFICATION


Description of squid gillnet operations for catching Ommastrephes bartramii. Investigative catches by two Japanese vessels, that fished across the northeast Pacific, including off Vancouver Island, are presented.

*7 BERNARD F R / GILLNET / EASTPACIFIC / O BARTRAMII / MIGRATION / ETP / DISTRIBUTION


A survey of cephalopods collected from San Diego to Alaska, which presents species descriptions and notes on distributions. The review includes a key to identification of known regional cephalopods, and 25
plates of illustrations.

*BERRY S S / EASTPACIFIC / L OPALESCENS / S OUALANIENSIS / OCTOPODA /
IDENTIFICATION


A key to and descriptions of cephalopods found in the Hawaiian Islands region. Includes illustrations and 11 plates.

*BERRY S S / PACIFIC / IDENTIFICATION / DISTRIBUTION / O BANKSII /
S OUALANIENSIS / OCTOPODA


Chapter 12, "Feeding", includes methodology for studying stomach contents and summaries of feeding habits investigations from worldwide areas. Stomach contents from Pacific Ocean sources have yielded 25 cephalopod and 37 fish species, the major portion being squids.

*3 BERZIN A A / PACIFIC / ETP / EASTPACIFIC / INDIAN / ATLANTIC / ANTARCTIC
MARINE MAMMALS / FEEDING HABITS / M ROBUSTA / D GIGAS / G BOREALIS /
ONYCHOTEUTHIS / OCTOPUS


A report of volumes of fishes, crustaceans, and cephalopods collected in the eastern tropical Pacific (1958-1961) in standard night hauls, in order to assess possible tuna prey. The study assumed that prey assessment could indicate the presence of yellowfin or skipjack tuna in unfished areas. Dominant cephalopods were Abraliopsis morisi and Leachia eschscholtzi, but cephalopods amounted to only 5% of the micronekton. Comparisons with stomach contents showed that micronekton surveyed was moderately different.

*3 BLACKBURN M / ASSESSMENT / SEASONAL / FEEDING HABITS / FISH /
DISTRIBUTION / NET / ETP / P GIARDI / PTERYGIOTEUTHIS / A MORRISII /
ABRALIOPSIS / ABRALIA / ONYCHOTEUTHIS / O BANKSII / LEACHIA /
L ESCHSCHOLTZI / PYRGOPSIS / L REINHARDTI / TEUTHOWENIA / C SICULUS /
CTENOPTERYX / OCTOPODOTEUTHIS / HISTIOOTEUTHIDAE / OMMASTREPHIDAE


Results of the 1967-1968 Eastropac oceanographic cruises, quantified to identify seasonal changes in chlorophyll a, zooplankton, and micronekton. Only night catches were quantified because daytime catches were one tenth the amount. Significant differences were seen in fish-cephalopod micronekton in the eastern cruise portion, based on latitude and
longitude but not on season.

*7 BLACKBURN M / LAURS R M / OWEN R W / ZEITZCHEL B / DISTRIBUTION / NET / ETP / ASSESSMENT / SEASONAL


Areal presentation of concentrations of skipjack tuna forage, in ml per 1000 cubic meters, from data collected during EASTROPAC expeditions, 1967-1968. As reported, tuna forage was the lumped biomasses of species such as epipelagic fishes, crustaceans and cephalopods, collected in micronekton nets.

*3 BLACKBURN M / LAURS R M / FISH / FEEDING HABITS / DISTRIBUTION / ETP


A 1973 survey of species composition and biomass of pelagic nekton, off Baja California. Since catches were principally galatheid crabs, acoustic data was related to biomass of the crabs.

*7 BLACKBURN M / THORNE R E / SONAR / NET / ASSESSMENT


A description of a squid bottom pair trawl. Mesh size and towing speed are discussed. Report suggests that mesh size should not be greater than 9-10 inches, and towing speed might be 3.5-4 knots.

*5 BLOTT A J / TRAWL / ATLANTIC / L PEALEI


Results of stomach contents examinations of 40 bigeye and 18 yellowfin tuna caught by longlines in the ETP. Bigeye prey items by volume were: cephalopods 63.2%, fish 21.6%, and crustaceans 15.1%. Dosidicus gigas represented 50% of the volume of bigeye stomach contents. Food of yellowfin by volume were: crustaceans 50.8%, fish 36.3%, and cephalopods 12.9%. Portunid crabs and Auxis sp. were the main constituents of yellowfin diet.

*3 BLUNT C E / FEEDING HABITS / ETP / D GIGAS / FISH / LONGLINE


A summary of results of studies, of a number of investigators, on
Cephalopod feeding, primarily in laboratory culture.

*6 Boletzky S V / Squid Diet / Sepiidae / Octopodidae / S Lessoniana / S Sepiodea / L Vulgaris / L Opalescens / L Pealei / L Plei / D Bleekeri / L Brevis / I Illecebrosum / T Pacificus


Basic principles involved in acoustic surveys of fish stocks. Coverage includes elementary acoustics, target strengths, integration of signals, calibration and quantification.

*7 Burczyński J / Sonar / Assessment


Six stages of maturity are presented, with conditions of mendantal glands, ovary development, gonad coefficients, oviducts, and maturation coefficients.

*6 Burukovski R N / Zouyev T V / Nigamatullin Ch M / Tsymbal M A / S Pteropus / Reproduction


History leading to development of present cephalopod fisheries off West Africa, and management conclusions and recommendations. Report indicates that cephalopods are highly opportunistic and have expanded into niches once occupied by sparid fishes.

*7 Caddy J F / Trawl / O Vulgaris / Sepia / Atlantic / Fishing


An investigation, using recurrent group analysis, of commercial anchovy purse-seine catches and midwater trawls to determine species co-occurrences with Loligo opalescens. Anchovy hauls showed strong association between L. opalescens and Engraulis mordax, while Merluccius productus was the only squid associate in both shallow and deep midwater trawls. No species had significant affinity with squid in winter midwater trawls.

*7 Calliet G M / Karpov K A / Ambrose D A / L Opalescens / Trawl / Purse Seine / Distribution / Seasonal / EastPacific / Assessment
electrophoretic study of select proteins from the market squid, Loligo
opalescens Berry. Calif. Dept. of Fish and Game Fish Bull. (169):123-
133.

An attempt to distinguish subpopulations of L. opalescens by enzyme
assay. Data could not verify if subpopulations existed.

squids in ICNAF subarea 5 and statistical area 6, 1964, as determined

Calculations of stratified mean catch per tow and population variance,
based on autumn bottom trawl surveys off New England. Although finfishes
decreased during 1963-1974, squid abundance appeared to increase. Total
biomass estimates show declines of 47-51% from 1964-1975; and increases
from 1975.

CLARKE, M. R. 1962. The identification of cephalopod "beaks" and the
relationship between beak size and total body weight. Bulletin of the
British Museum (Natural History) 8(10):421-480, plates 13-22.

Methods for squid (and octopod) identification and weight estimation,
using beak characteristics. Family and species beak descriptions,
regressions of total body weight on rostral length, keys to families by
upper and lower beak characters, and photographs of beaks are presented.

CLARKE, M. R. 1965. Large light organs on the dorsal surfaces of the squids
Ommastrephes pteropus, 'Symplectoteuthis oualaniensis' and 'Doscidicus

Description of photogenic organs, present in young females and males of
O. pteropus. Pacific S. oualaniensis were not found to possess a similar
organ, while those of the Indian Ocean did. Contrary to previous report,
D. gigas did not possess the organ, which may indicate stock
differentiation.


An extensive review of the distribution, depth, and life history of
oceanic squid, presented in taxonomic sequence. Predators, sizes as
presented by mantle length, and depth distribution of families are summarized. Because many oceanic squid are fast swimmers, and are able to evade sampling gear, squid ecology is poorly known.


Report of evidence that male sperm whales larger than about 37 feet migrated from the Antarctic before being caught off Durban. Evidence came from examination of stomach contents of female, young male, and large bull whales. The percentage of Antarctic cephalopod beaks from males increased with the size of the whale. Possible explanations are that larger whales migrate further south, or that smaller whales take longer to travel from the Antarctic.

*3 CLARKE M R / MARINE MAMMALS / FEEDING HABITS / ANTARCTIC / ATLANTIC / DISTRIBUTION / MIGRATION


A number of comparisons of cephalopod assessment results. Sampling techniques included were nets (Engels midwater trawl, Isaacs-Kidd midwater trawl, rectangular midwater trawl, British Columbia midwater trawl, and ring nets), stomachs (whales, porpoises, birds, seals, sharks, and tuna), and surface observations. Curves of cumulative species composition versus family, by region, show differences due to sampling techniques. Clarke concludes that there are more cephalopods than net sample analysis alone suggests.

*7 CLARKE M R / FEEDING HABITS / TRAWL / MARINE MAMMALS / SEABIRDS / FISH / ATLANTIC / PACIFIC / EASTPACIFIC / ANTARCTIC / INDIAN / NET / ASSESSMENT WORLDWIDE


A study of sperm whale feeding on cephalopods, from stomach samples collected at South Africa, Australia, South Georgia, and the south Atlantic. Presentation of cephalopod occurrence was by size and sex of whales, by cumulative percentages, by region and by season. Report shows regressions of cephalopod wet weights on beak lengths, and presents systematics and ecology of collected cephalopods, with descriptions and illustrations of flesh remains and lower beaks.

*3 CLARKE M R / MARINE MAMMALS / FEEDING HABITS / DISTRIBUTION / SEASONAL / ANTARCTIC / ATLANTIC / PACIFIC / INDIAN / MORPHOMETRICS / ARCHITEUTHIS / TODARODES / KONDAKOVIA / MOROTEUTHIS / VAMPYROTEUTHIS / ALLOPSUS /
LIOCRANCHIA LEPIDOTEUTHIS / OCTOPOTEUTHIS / TANINGIA / CHIROTEUTHIS / MESONYCHOTEUTHIS / GALITEUTHIS / CYCLOTEUTHIS / CRYSTALLOTEUTHIS / GONATUS / PHOLIDOTEUTHIS / TAONIS / HISTIOTEUTHIS / ANCISTROCHEIROS / MASTIGOTEUTHIS / DISCOTEUTHIS / PHASMATOPSIS


Presentation of the use of stomach contents examinations to provide information directly relevant to food web studies. Lower trophic dynamics can be provided by study of stomachs of cephalopods caught in nets or collected from predator stomachs. Beak identification (with body weight regressions on beak size) can overcome estimation problems due to partial digestion. From the study of cephalophages, total cephalopod population may be estimated.

*7 Clarke M R / Marine Mammals / Seabirds / Fish / Feeding Habits / Assessment / Squid Diet


Report of stomach contents of 151 blue sharks caught off Cornwall and in the Bay of Biscay. Oceanic cephalopod remains in sharks caught off Cornwall could indicate recent migration of the sharks to that area. Sharks ate many cephalopod species rarely caught in research nets.

*3 Clarke M R / Assessment / Stevens J D / Fish / Feeding Habits / Atlantic T Megalops / Phasmatopsis / H Reversa / H Bonnellii / T Eblanae / O Caroli / G Fabricii / Octopoteuthis / Rossia / S Officinalis / E Cirrhosa / Histioteuthis


Comparisons with data from Nesis (1973a) showed that sperm whales sampled larger and different squids than did trawls. The presence of Gonatus and Mesonychoteuthis may have indicated northward migration from the Antarctic. Lower beaks of six species are described and lower beak length frequency distributions are presented for all cephalopods sampled.

*3 Clarke M R / MacLeod N / Paliza O / EastPacific / Identification / ETP / Marine Mammals / Feeding Habits / Histioteuthis / D Gigas / Chiroteuthis Octopoteuthis / T Danae / G Antarcticus / A Lesueurii / Symplectoteuthis / T Megalops / Phasmatopsis / M Hamiltoni / Moroteuthis / Psychroteuthis / V Infernalis

Squid lower beaks identified and squid weights estimated in stomachs of two bottlenosed whales stranded off Denmark. Although Gonatus fabricii made up 99% and 74% of the lower beaks found in the two whales, total cephalopod composition may indicate whale movements. Vampyroteuthis remains in one whale may show southward migration.


Examination of cephalopod beaks from the stomach of a stranded 34 ft male sperm whale. Regressions of cephalopod weight on lower rostral lengths allowed comparisons of species by weight. Species composition indicated that the whale had migrated from the Antarctic and had fed along the way on South American cephalopods from the continental slope.


A study of regurgitations, from seven adult fur seals, surveyed the cephalopod portion of stomach contents (squid, fish and nematodes). Out of 275 lower squid beaks, 96% were Onychoteuthis banksi. The distribution of lower rostral lengths of O. banksii was presented. Squid which made up diet, by weight, were O. banksii (73%), ommastrephids (26%), and other (1%).

A study of cephalopods from regurgitations of both chick and adult albatrosses. Most likely, birds fed at dusk and dawn, as indicated from the cephalopod species and habits.

*3 CLARKE M R / PRINCE P A / SEABIRDS / FEEDING HABITS


Cephalopod sampling, via 66 sperm whale stomach contents from animals caught commercially. Results indicate that cephalopods make up a larger portion of the standing stock of nekton than net sampling would suggest.

*3 CLARKE M R / MACLEOD N / MARINE MAMMALS / FEEDING HABITS / PACIFIC


A first detailed study of the cephalopod diet of Weddell seals indicated that all squids identified, except one, were also part of sperm whale diets. While many squids found in seal stomachs were also prey of albatrosses, the proportions and diversities of squid species varied considerably.

*3 CLARKE M R / MACLEOD N / BIRDS / MARINE MAMMALS / FEEDING HABITS / ANTARCTIC


General summary of multispecies approaches which use models of predator-prey relations, for Gulf of Maine and Georges Bank fishes. Importance was placed on pre-recruit predation and feeding habits studies.

*7 COHEN E / GROSSLEIN M / SISSENWINE M P / SERCHUK F / BOWMAN R / MODEL / FEEDING HABITS / FISH / ATLANTIC


Food habits survey of commercial fishes showed that arrow squid was not an essential prey item. Investigation followed concern that squid fishing might affect other fisheries.

*3 COLEMAN N / HOBDAY D / PACIFIC / FISH / FEEDING HABITS

Presentation of the background and present state of Japan's squid fisheries. After 1969, with declining CPUE, the Todarodes pacificus fishery was regulated, but resource management has been neglected. Other squid fisheries are concentrated in New Zealand and off the east coast of North and South America. Test fishing ventures have been sent to Ecuador, Mexico, New Zealand, and Australia. Recently, Japan's quota of imported squid has increased; in 1978, 122,000 tons was imported, of which 1,900 tons was Loligo opalescens.

*4 COURT W G / PACIFIC / ATLANTIC / T PACIFICUS / O BARTRAMII / L PEALEI / I ILLECEBROSUS / I ARGENTINIUS / N SLOANI GOULDI / JIGGING / TRAWL / GILLNET / FISHING


Review of the preparation of statoliths and interpretation of growth rings, from the literature dealing with Illex illecebrosus, Loligo opalescens and Gonatus fabricii. Back calculations based on growth rings have consistently underestimated mantle lengths. Suggestions to avoid such shortcomings, in this method of aging, are presented.

*6 DAWE E G / ATLANTIC / EASTPACIFIC / AGING / I ILLECEBROSUS / G FABRICII / L OPALESCENS / GROWTH


A general overview of the California fishery for Loligo opalescens. Contains annotated bibliography with 27 references.

*4 DEWEES C M / PRICE R J / EASTPACIFIC / L OPALESCENS / FISHING / LIGHTS / NET / LAMPARA / SONAR / PURSE SEINE / PUMP / D GIGAS


Description of several types of bottom trawls, with dimensions and meshsizes. Best type was a medium opening bottom trawl (6 to 7 m vertical opening) with long wings.

*5 ENGEL H H / TRAWL / FISHING / L PEALEI / ATLANTIC


Contains section entitled "Diet, diving and feeding behavior", in which
diets of "southern California continental borderland" dolphins are described. Fall and winter collected animals contained 63% fish and 37% squid (99% Loligo opalescens), while spring and summer collections contained 70% fish, 23% cephalopods (85% onychoteuthids and 15% L. opalescens), and 7% crustaceans. Comparison of food availability was made with commercial fish catches.

*3 EVANS W E / EASTPACIFIC / MARINE MAMMALS / FEEDING HABITS / L OPALESCENS ONYCHOTEUTHIDAE


Contains papers which include references to predation upon cephalopods (South American Sea Lion, South American Fur Seal, and California Sea Lion).

*3 FAO / MARINE MAMMALS / FEEDING HABITS / ETP / EASTPACIFIC


Report of cephalopod fisheries off northwest Africa. Production models, catch statistics, length frequency analyses, gear selectivity and biology are discussed. Both Fox and Schaefer models suggest that stocks are overexploited. Appendices are in French and Spanish.

*7 FAO / O VULGARIS / S OFFICINALIS / L VULGARIS / MODEL / ASSESSMENT / GROWTH / REPRODUCTION / ATLANTIC / STOCK


Monograph on the common, coastal east Pacific lolignid, Loligo opalescens. Descriptions of growth, reproduction, fisheries, and predator-prey relations are included.

*6 FIELDS W G / L OPALESCENS / GROWTH / REPRODUCTION / SEASONAL / DISTRIBUTION / MORPHOMETRICS / SQUID DIET / FISH / MARINE MAMMALS / FEEDING HABITS / EASTPACIFIC / PARASITE


A survey which collected 17 cephalopods, on the 1968 cruise of the RV Te Vega. Collection methods used were Tucker trawl, bongo net, handline and regurgitations of a Colombian booby.

*2 FIELDS W G / GAULEY V A / ETP / MORPHOMETRICS / OCTOPUS / JAPETELLA / A AFFINIS / B ABYSSICOLA / B BACIDIFERA / D GIGAS / S OUALANIENSIS / H PFEFFERI / SYMPECTOTEOULTHIS

Distribution of squids based on 3,000 specimens, collected by research and fishing vessels, 1959-1967, from 272 stations worldwide.


Survey of squid from examination of stomach contents of northern fur seals, Dall's porpoise, Pacific white-sided dolphins, saddleback dolphins, killer whales, and sperm whales, from central California to the Bering Sea. Based on frequent occurrences, Loligo oaleiscens, Onychoteuthis borealijaponicus, Berryteuthis magister, and Gonatopsis borealis could probably support northern commercial fisheries.


A report of incidental catches of squids in salmon research gillnets, in latitudes 40 N to 60 N, and longitudes 125 W to 180 W. Gillnet mesh was between 64 and 133 mm stretch measure, and catches were greatest in 64 and 83 mm meshes. O. borealijaponicus was most abundant and could probably support a jig fishery; and, O. bartramii presented a potential for commercial gillnetting.


A description of squid jigging gear and fishing operations on Japanese vessels.


Review of the use of lights for attracting squid during jigging
operations. Paper discusses incandescent, mercury, halogen, fluorescent, and underwater lighting. Differences in squid response to the various light types probably results from species related reactions.

*5 FLORES E E C / LIGHTS / JIGGING / PUMP / PURSE SEINE / FISHING


Study which suggests the absence of color vision in squid. An extension of these results can be applied to squid line fishing; rather than color, contrast of the jig against the surrounding water would be most important.

*6 FLORES E E C / IGARASHI S / MIKAMI T / JIGGING / T PACIFICUS


Study found that O. bartramii of the South Atlantic was infected by one trematode species, three cestodes and two nematodes, which are described. Probable developmental cycles are presented.

*6 GAEVKSKAYA A V / PARASITE / O BARTRAMII / ATLANTIC


Paper states that extent and intensity of infection is significantly higher in oceanic Atlantic Ocean ommastrephids than in neritic species, and that tropical squids have higher infection rates than temperate ones.

*6 GAEVKSKAYA A V / PARASITE / ATLANTIC / OMMASTREPHIDAE / SQUID DIET


Paper reports a correspondence of the trophic and parasitic relationships of Ommastrephes bartramii. Most of the helminthofauna of this squid were similar in the North and South Atlantic although the squid stocks have been separate for 15-20,000 years.

*6 GAEVKSKAYA A V / NIGAMATULLIN CH M / O BARTRAMII / ATLANTIC / PARASITE / DISTRIBUTION / SQUID DIET / FISH / MARINE MAMMALS / FEEDING HABITS / STOCK

Identifications of cephalopod lower beaks found in two sperm whales. Beaks were separated into 11 types, and then types were compared to beaks obtained from whole squid.

*3 GASKIN D E / CAWTHORN M W / MARINE MAMMALS / FEEDING HABITS / MOROTEUTHIS N SLOANI / H COOKIANA / ARCHITEUTHIS / S BILINEATA / OCTOPODA / PACIFIC / IDENTIFICATION


Investigation, which utilized three different approaches, to determine sources of backscattering from the oceanic backscattering layer. Although the approaches (one theoretical, two sampling) gave similar results, there were some discrepancies between approaches. Backscattering sources were fish, squid, and large zooplankton. Fish and squid were found early in the evenings, while euphausiids appeared later at night.

*7 GREENBLATT P / SONAR / ASSESSMENT / EASTPACIFIC / NET


Upward and downward migrations of fish, squid, and plankton were measured with a horizontally aimed 87.5 kHz sonar. Resolution was between 17 and 400 m. Scattering strengths of upward migrations were stronger than of downward migrations, and may indicate that organisms were more concentrated during upward migrations.

*7 GREENBLATT P / SONAR / EASTPACIFIC / ASSESSMENT


Report of acoustical estimation of the size distribution and abundance of euphausiids, using measurements at several frequencies.

*7 GREENLAW C F / SONAR / ASSESSMENT


Description of male squid reproductive system and maturation, using electron microscopy of testicular tissue or spermatophores. Results suggest that males spawn just once, and then die.

*6 GRIEB T M / BEEMAN R D / L OPALESCENS / REPRODUCTION / EASTPACIFIC

Overview of surumeika (Todarodes pacificus) fishing, including a history leading to the development of present jigging methods, and biological information. Also, Japanese overseas squid fishing operations, such as for Dosidicus gigas, are summarized.

HAMABE M / KAWAKAMI T / WATABE T / OKUYA T / T PACIFICUS / LIGHTS / JIGGING / D GIGAS / REPRODUCTION / GROWTH / ATLANTIC / PACIFIC / ETP / MIGRATION / FISHING


Description of squid jigging gear and its operation. Lighting, jig types, vessel layouts, and squid processing are among the topics discussed.

HAMABE M / HAMURO C / OGURA M / JIGGING / LIGHTS / FISHING


Three types of lighting were used to attract squids: surface incandescent, surface quartz-iodide and underwater mercury vapor. Four species were collected from the underwater habitat which was operated at depths between 13 and 40 m.

HANLON R T / HIXON R F / FORSYTHE J W / HENDRIX J P / LIGHTS / ATLANTIC / A VERANYI / OMMASTREPHES / LOLIGO / S SEPIOIDEA


A study of the ecology and biology of waved albatross, from colonies on the Galapagos Islands. A food habit survey, using regurgitations, showed that squid was a major diet item. About 80% of squid beaks were histioteuthids and octopoteuthids; however, ommastrephids comprised the major fraction of biomass, from estimates of mean weights based on beak sizes.

HARRIS M P / FEEDING HABITS / SEABIRDS / ETP / S OUALANIENSIS / CALLITEUTHIS / ONYCHOTEUTHIS / MOROTEUTHIS / PHOLIDOTEUTHIS / HISTIOTEUTHIDAE / OCTOPODEOTEUTHIDAE / OMMASTREPHIDAE / CHIROTEUTHIDAE / ONYCHOTEUTHIDAE / ENOPLOTEUTHIDAE / ONYCHOTEUTHIDAE / PHOLIDOTEUTHIDAE

Contains a list of cephalopod genera containing luminous species. Presents illustrations of the positions of light organs on 25 cephalopods.

HERRING P J / IDENTIFICATION / SYMPLECTOTEUTHIS / OMMASTREPHES / GONATUS ONYCHOTEUTHIS / HISTIOTEUTHIS / OCTOPOTEUTHIS / ABRALIOPSIS / CRANCHIA / LOLIGO / BATHYTEUTHIS / GALITEUTHIS


Presentation of techniques used to identify 15 cephalopod species, from a feeding habits study of 65 broadbill swordfish caught off Florida. Methods can be applied to other predators and other oceanic areas, because there were a number of cosmopolitan cephalopod species.

HESS S C / TOLL R B / IDENTIFICATION / PACIFIC / INDIAN / MEDITERRANEAN / FISH / FEEDING HABITS / ATLANTIC / O BANKSII / A LESUEURI / T MASSYAE / ARCHITEUTHIS / H DOFLEINI / C SICULUS / O PTEROPUS / O ANTILLARUM / T RHOMBUS / C SCABRA / J DIAPHANA / ARGONAUTA


Details of seven specimens collected in the Santa Barbara Channel from 1967-1974. M. robusta is a major prey of sperm whales.

HOCHBERG F G / EASTPACIFIC / M ROBUSTA / SQUID DIET


Review of cephalopod biology, followed by descriptions of California species.

HOCHBERG F G / FIELDS W G / EASTPACIFIC / R PACIFICA / L OPALESCENS / D GIGAS / M ROBUSTA / OCTOPODA / PARASITE


Collection of cephalopods from the 1891 Albatross cruise in the ETP, and a smaller collection from the Albatross 1899-1900 across the tropical Pacific. Contains 12 plates, and descriptions of light organs of two squids.

HOYLE W E / ETP / PACIFIC / OCTOPODA / L DIOMEDEA / S QUALANIENSIS / B ABYSSICOLA / M DENTATA / O CARRIBAEA / A HOYLEI / ABRALIOPSIS / P GIARDI / C REVERSA / C SCABRA / TAONIS

Stomach of a large male elephant seal, harpooned by swordfish fishermen, contained sharks, skates, ratfish and squid.

*3 HUEY L M / MARINE MAMMALS / FEEDING HABITS / EASTPACIFIC / L OPALESCENS


Behavioral study of schooling of Loligo opalescens in laboratory experiments. Measurements of angular orientation suggested that larger squid create more cohesive schools than do smaller ones. Vision was the primary sensing system involved in schooling.

*6 HURLEY A C / L OPALESCENS / DISTRIBUTION / CAMERA


A summary of population estimates, using three models: areal expansion, Leslie-Delury method and cohort analysis. Leslie and cohort analysis yielded similar estimates, while areal expansion gave a much larger estimate.

*7 HURLEY G V / WALDRON D E / I ILLECEBROSUS / MODEL / ASSESSMENT / ATLANTIC TRAWL


An examination of "growth" rings in squid statoliths using both scanning electron microscopy and light microscopy. Study found good prediction of mantle lengths from ring counts, but back calculated lengths were much lower than expected values.

*6 HURLEY G V / BECK P / ATLANTIC / GROWTH / AGING / I ILLECEBROSUS


Report of study which showed that there was no difference in motion between hand crank and automatic machines, when the latter was operated at medium speed with a jerking motion. In Japanese, with English abstract and figure captions.

*5 IGARASHI S / MIKAMI T / JIGGING

A study of albacore prey from 544 fish collected from 1950 to 1957, by longline, trolling and gillnet. Food items were (by method of capture and volume): longline- fish (47%), squid (41%), and crustaceans (7%); gillnet- fish (34%), squid (62%), and crustaceans (2%); trolling- fish (79%), squid (11%), and crustaceans (6%). Amounts of squid in albacore stomachs, collected in equatorial regions, increased with distance from land.

*3 IVERSEN R T B / FISH / FEEDING HABITS / PACIFIC / LONGLINE / LINE / GILLNET / OCTOPODIDAE / ARGONAUTIDAE / LOLIGINIDAE / SEPIOTEUTHIS / SEPIOLIDAE / ONYCHOTEUTHIDAE / ENOPLOTEUTHIDAE / OMMASTREPHIDAE / SYMPELECTOTEUTHIS / BRACHIOTEUTHIS / CRANCHIIDAE


A survey of albacore stomachs from the 1968 and 1969 seasons, in three areas: southern California, central California, and Oregon-Washington. Digestion of squids obscured their impact in diet, but an index of relative importance showed squid second to fish.

*3 IVERSON I L K / EASTPACIFIC / FISH / FEEDING HABITS / L OPALESCENS / O BOREALIJAPONICUS / M ROBUSTA / A FELIS / O SICULA / GONATUS / GONATOPSIS / LEACHIA / H HETEROPSIS / D GIGAS / M DENTATA / V INFERNALIS / O CALIFORNIANA / ARGONAUTA / O TUBERCULATA / O BIMACULATUS


A guide to the identification of 20 species of cephalopods, utilizing upper and lower beaks. Size, and front and side views are provided.

*1 IVERSON I L K / PINKAS L / IDENTIFICATION / L OPALESCENS / M ROBUSTA / O BOREALIJAPONICUS / A FELIS / O SICULA / H HETEROPSIS / G ANONYCHUS / GONATUS / GONATOPSIS / D GIGAS / M DENTATA / C SCabra / LEACHIA / R PACIFICA / V INFERNALIS / O CALIFORNIANA / ARGONAUTA / O TUBERCULATA / O BIMACULATUS


The results of a cooperative survey between Japan and Australia, which utilized a vessel equipped with 28 squid jigging machines and 60 lights of 21 kW total output. Catch of squid over a 120 day period was 120,672 kg Nototodarus sloani gouldi, and 3,608 kg Todarodes filippovae. Mantle length, body weight, sex, maturity, and stomach contents were sampled. Recaptured tagged squid, and catches showed limited migration during that fishing period.

*7 N SLOANI GOULDI / T FILIPPOVAE / JIGGING / LIGHTS / TAGGING / PACIFIC /
NET / SQUID DIET / ASSESSMENT


Report of cephalopods, collected during rockfish surveys, in 36 (out of 267 total) bottom trawl hauls. Dominant species were Berryteuthis magister (57%) and Octopus spp. (31%).

*2 JEFFERTS K / PEARCY W G / EASTPACIFIC / TRAWL / O CALIFORNIANA / OCTOPUS R PACIFICA / G BERRYI / M ROBUSTA / G MADOKAI / B MAGISTER


A description of the present state of squid fisheries in South America. Statistics for all fisheries, including squid, are presented, according to country and from 1970 to 1978. On the Pacific coast, the major squid species landed has been Dosidicus gigas, with a lesser amount of Loligo. Because of exportation, traditional food preferences, and marketing, there is little demand for squid by South Americans.

*4 JUANICO M / EASTPACIFIC / ETP / ATLANTIC / D GIGAS / L GAHI


Trawl assessment of two lolignid squids showed that only few of one species type were found with the other, although a non-parametric co-occurrence index indicated high spatial overlap. Both species showed high patchiness.

*7 JUANICO M / L PLEI / L BRASILIENSIS / TRAWL / ASSESSMENT


Summary of stomach contents of five bigeye and ten yellowfin tuna caught by longline gear. Prey volumes for the entire sample were 58.7% fish, 27.2% squid, and 15.0% portunid crabs.

*3 JUHL R / ETP / FISH / FEEDING HABITS / D GIGAS


Background information and possible use of sonar biomass estimation in power plant applications. Includes 430 references to varied literature
including pelagic studies, equipment, signal processing, statistical analyses, and more.

*7 KANCIRUK P / SONAR


Similar to Karpov and Calliet (1979). See annotation for content.

*6 KARPOV K A / CALLIET G M / L OPALESCENS / EASTPACIFIC / TRAWL / SQUID DIET


Investigation of squid feeding habits, in the Monterey Bay area, from squid collected in bottom trawls during the day, and in midwater trawls both at night and day. Squid fed mainly on crustaceans; size of squid made little difference to prey composition, but depth of capture showed different feeding strategies.

*6 KARPOV K A / CALLIET G M / L OPALESCENS / EASTPACIFIC / SQUID DIET / TRAWL


Thirteen measurements of body parts and four sexual maturity codes were used to investigate possible geographic subpopulations of squid. Two measurements clearly indicated sexual dimorphism. Data may indicate three geographic groups: Baja California, northern and central California, and Puget Sound.

*6 KASHIWADA J / RECKSIEK C W / MORPHOMETRICS / L OPALESCENS / EASTPACIFIC / STOCK / TRAWL / JIGGING / NET


Regressions of squid mantle lengths on various squid beak measurements. Comparisons of body size-beak dimension relationships, from squids caught at Monterey and Southern California, revealed no significant differences between areas.

*6 KASHIWADA J / RECKSIEK C W / KARPOV K A / L OPALESCENS / EASTPACIFIC / MORPHOMETRICS

Summary of the Loligo opalescens fishery off California. A short description of the squid's life history is given, followed by a review of the Southern California and Monterey area fisheries. Fishing methods were by brailing under lights, by hydraulic pumps, by purse seining, and by lampara, a roundhaul net. Fishing regulations prohibit the use of lights or purse seines in the Monterey area. Squid in both areas have been located by associated marine mammals and seabirds.


Examples of echo-traces obtained from 14, 28, 50, 75, and 200 kHz sounders on Japanese research vessels in the Sea of Japan. Report concluded that squid could be recorded throughout the day, whether the ship was underway or stopped.

*7 KAWAGUCHI T / NAZUMI T / SONAR / ASSESSMENT / PACIFIC


A collection of five squid species, found in the stomachs of eight sperm whales captured off Japan in 1972.

*3 KAWAKAMI T / MARINE MAMMALS / FEEDING HABITS / M ROBUSTA /GONATUS / G BOREALIS / O BARTRAMII / H DOFLEINI / PACIFIC


Review reports that cephalopods predominate in sperm whale diets. Cephalopod species are reported by oceanic region, and consist of 36 genera (31 squid genera) and 19 families.

*3 KAWAKAMI T / MARINE MAMMALS / FEEDING HABITS / PACIFIC / ATLANTIC / INDIAN / ANTARCTIC / A LESUEURI / OCTOPOTEUTHIS / T DANAE / MOROTEUTHIS / PSYCHROTEUTHIS / G ANTARCTICUS / CYCLOTEUTHIDAE / HISTIOTEUTHIS / D GIGAS SYMPECTOTHEUTHIS / CHIROTEUTHIS / T MEegalops / PHOLIDOTEUTHIDAE / VAMPYROTEUTHIS / OCTOPODIDAE


Of 895 whales, 3.6% were observed to vomit food (16.8% of sperms, 1.1% of seis, and 0.785 of fins). Fin and sperm whales were observed to vomit squid.

Review indicates that squids play a minor role in the diet of some balaenopterid whales. References to the literature are categorized by oceanic region.


An examination of stomachs from 439 yellowfin and 166 bigeye tuna, collected by longline from 1950-1953 in the central Pacific. Food of yellowfin were by volume: fish (62%), squid (29%), other mollusks (7%), and crustaceans (1%). Bigeye prey were: fish (62%), squid (33%), other mollusks (3%), and crustaceans (2%). The diet of yellowfin and bigeye tuna was similar, and the study concludes that both species have the same feeding habits.


Species compositions of 274 hauls, utilizing four types of midwater trawls, in order to monitor juvenile tunas and tuna food resources. Comparisons with yellowfin tuna stomach contents showed that trawls did not sample tuna prey (which included ommastrephid and loligoid squids).

Report of fishing of giant squid, Dosidicus gigas, which has become a prospective major fisheries resource in the Gulf of California. Squid landings, for 1980, are presented according to eight areas, and by season. Landings of squid were 552 tons in 1978, 2,510 tons in 1979, and 8,180 tons in 1980.


A study which found no evidence for single spawning. However, no site for future spawning was found either.


Report of distributional data on ommastrephid species, compiled from several Russian research cruises. Worldwide occurrences are reported for both cosmopolitan and endemic species.


Description of Japanese octopus trawling gear (West Africa) and squid (Loligo, Northwest Atlantic) trawling gear, with dimensions and mesh sizes.


Relation of concentric growth rings in Gonatus fabricii statoliths to growth and time. Methods of preparation and interpretation are presented. Besides daily increments, fortnightly and monthly bands were seen.

29

Descriptions of 13 larval cephalopods, and keys to their identification.


Report of mesh selectivity, in catching Ommastrephes bartrami, using a salmon research gillnet. Mesh sizes varied from 42 to 157 mm. Gillnets were non-selective for squid having 18-50 cm dorsal mantle lengths. Catching efficiency for squid was higher than for salmon. In Japanese with English abstract.


Description of large scale approach to ecosystem simulation. Model used was a top down (upper end of the food pyramid), biomass based one. Equilibrium biomasses in the Bering Sea are presented for present and natural state conditions, for 20 groups or species, including squid.


Simulation of the effects of fishing on Atlantic squid, using a modified Ricker yield-per-recruit model for two cohorts. Mesh size of capture gear and monthly values of growth, spawning, fishing, and natural mortality are incorporated into the model. Yield-per-recruit increased with mesh sizes larger than used in the present fishery.


Discussion of the distributions, reproduction, growth, life cycles, food web relations, and fisheries of northwest Atlantic squid. Length
frequency analyses and research cruise abundances (stratified mean weights per tow) are reported. A dynamic pool model (Sissenwine and Tibbetts 1977), to simulate fishing effects on abundances, is presented. 


Abundance of an estuarine-tolerant squid, Lolliguncula brevis, in relation to salinity, temperature, and food availability. Squid abundance was determined using repetitive otter trawls at speeds of 1.5 m/sec.


Five stages of gonad development were described, and gross characteristics were related to oocyte maturity. Specimens for the study were captured using squid jigs and dipnets, and then frozen or preserved chemically until examination. Relationships between dorsal mantle length and gonad length, nindamental gland length, and body weight were presented.


Observations of four Atlantic Ocean ommastrephid squids made while fishing with hand operated jigging machines. Blue light failed to attract squid, while red light reduced feeding activity; catch was best when no color filters were on white halogen lamps. Buildup, depth and concentration was measured by a 30 kHz sounder. Illex illecebrosus and Martialia hyadesi formed massive and stationary concentrations, while Ommastrephes spp. remained close to the light/shadow interface in weakly defined groups and then congregated at 350-400 m at dawn.

Description of exploratory squid jigging for Illex illecebrosus, on two Polish research vessels, during August and September 1979, off Cape Cod. Report describes gear and techniques (jigs, line, automatic jigging machines, lighting, fishing and processing). Average squid catches, per night, were 2850 kg and 2130 kg for the two vessels.

*5 LONG D / RATHJEN W E / JIGGING / I ILLECEBROSUS / LIGHTS / ATLANTIC / ASSESSMENT


Discussion of the acoustic target strength of fish. Variations of target strength depend on aspect of individual fish. Interference effects and quantification are also discussed.

*7 LOVE R H / SONAR / ASSESSMENT


A guide which features diagnostic characteristics of eight ommastrephid squids. Also included are brief descriptions of some non-ommastrephid squids found in Australian waters.

*1 LU CC / DUNNING M / IDENTIFICATION / OMMASTREPHIDAE / O BARTRAMII / S OUALANIENSIS / S LUMINOSA / O VOLATILIS / H PELAGICA / T FILIPPOVAE / N GOULDI / T EBLANAE


Comparisons from 50 and 200 kHz soundings taken around the long axis of Loligo and Trachurus japonicus and with the use of polar diagrams. The target strength of squid was less than of fish, while the number of lobes and fluctuations of echo strength were greater for squid.

*7 MATSUI T / TERAMOTO Y / KENEKO Y / SONAR / LOLIGO


Presentation of domestic U.S. fisheries for squid and their potential, in the Western Atlantic, Gulf of Mexico, and Eastern Pacific. Much of the U.S. catch has been exported or used for bait due to lack of domestic demand; and, foreign vessels have taken much of the squid caught in U.S. waters. Sources of squid fisheries statistics are given.

*4 MATSUMOTO W M / ATLANTIC / EASTPACIFIC / L OPALESCENS / D GIGAS / PUMP / LAMPARA / TRAWL / JIGGING / L PEALEI / L PLEI / L BREVIS / I ILLECEBROSUS O PTEROPUS / P ADAM1 / S OUALANIENSIS / O BARTRAMII /
O BOREALIJAPONICUS / B MAGISTER / G BOREALIS / G ONYX / G FABRICII / ASSESSMENT / FISHING


Presentation of yield models which incorporate predator-prey interactions: whale-krill, whale-seal-krill, and whale-cephalopod-krill. One outcome of these models is that the MSY for single species approaches is greater than for multispecies.

*7 MAY R M / BEDDINGTON J R / CLARK C W / HOLTS S J / LAWS R M / MODEL / MARINE MAMMALS / FEEDING HABITS / SQUID DIET


SCUBA diving observations of squid copulation and egg-laying. A higher proportion (63%) of dead and dying adult squid were males. Eggs were reared in the laboratory and required 30-35 days to hatch.

*6 MCGOWAN J A / EASTPACIFIC / L OPALESCENS / REPRODUCTION / GROWTH


An atlas of Thecosomata, Heteropoda and Cephalopoda, taken by zooplankton tows on six cruises from 25°N to 45°N in the California current region. Distributions are given for nine larval cephalopod species.

*2 MCGOWAN J A / DISTRIBUTION / EASTPACIFIC / ETP / OCTOPUS / ABRALIOPSIS / G FABRICII / L OPALESCENS / P GIARDI / P PACIFICA / O BANKSII / OCTOPODOTEUTHIS / C VERANYI


Description of A. felis, which was the most abundant squid in a larval cephalopod survey off California. Records of ETP species, A. affinis, are presented.

*6 MCGOWAN J A / OKUTANI T / MORPHOMETRICS / IDENTIFICATION / EASTPACIFIC / ETP / A AFFINIS / A FELIS


A food habits survey of 321 Pacific coast albacore, caught during the summers of 1949 and 1950. Food items were, by volume: Pacific saury 50%, squids 12%, Pleuroncodes planipes 11%, euphausids 7%, and northern anchovy 4%; by occurrence in stomachs: squids 80%, sauries 55%,
euphausids 54%, amphipods 43%, P. planipes 27%, and rockfish 22%. Absence of oegopsid squid normally caught near surface was thought to indicate that albacore may feed at some depth.

*3 MCHUGH J L / FISH / FEEDING HABITS / EASTPACIFIC / ABRALIOPSIS / PYRGOPSIS / O BANKSII / ONYCHOTEUTHIS / OCTOPUDA / GONATUS / P MICROLAMPAS / GONATOPSIS / O NIELSEN / ENOPLOTEUTHIDAE / CRANCHIIDAE / PTERYGIOTEUTHIS / CHIROTEUTHIDAE / OMMASTREPHIDAE / LOLIGO / OCTOPODOTEUTHIS


Survey which showed a time lag of 18 months between temperature and squid catch, which is consistent with life-span estimates.

*7 MCINNIS R R / BROENKOW W W / L OPALESCENS / EASTPACIFIC / DISTRIBUTION


Measurements of Cs/K and assignations of trophic levels (based in part on comparisons of indices of relative importance) showed that Cs/K ratios increased with trophic level, in two Pacific Ocean ecosystems, one in the ETP and one in the Southern California Bight. Loligo opalescens ratios clustered into a primary carnivore group, while Sympleクトotethysis oualaniensis ranked somewhat higher, midway to the next trophic level.

*3 MEARNS A J / YOUNG D R / OLSON R J / SCHAFER H A / ETP / EASTPACIFIC / S OUALANIENSIS / L OPALESCENS / SQUID DIET / FISH / FEEDING HABITS / MARINE MAMMALS

MERCER, M. C. 1975. Modified Leslie-DeLury population models of the long finned pilot whale (Globicephala melaena) and annual production of the short-finned squid (Illex illecebrosus) based upon their interaction at Newfoundland. J. Fish. Res. Board Can. 32:1145-1154.

Population estimations (for years 1947, 1952, and 1955) of long finned pilot whales in the North Atlantic, derived by methods of Leslie and DeLury, and assuming the catchability of whales was proportional to the catch of squid. Based on whale stock sizes, their consumption of squid is calculated. A conclusion drawn is that the depletion of whales has released squid to fisheries and other predators.

*7 MERCER M C / MARINE MAMMALS / FEEDING HABITS / TRAWL / JIGGING / ASSESSMENT / MODEL / I ILLECEBROSUS / ATLANTIC


Presentation of papers by several persons, dealing with squid resources. Pearcy suggested large midwater trawls for pelagic sampling. Laevastu
treated squid as a general group, part of an ecosystem model in which he estimated 400 million tons based on sperm whale consumption. Other topics covered were trophic relations with fur seals, seabirds, and cetaceans, food consumption and growth of Todarodes pacificus, and larval assessment.

*MERCER R W / TRAWL / MODEL / ASSESSMENT / FEEDING HABITS / MARINE MAMMALS SEABIRDS / EASTPACIFIC / PACIFIC


Squid assessment by trawl surveys on the Scotian Shelf, Georges Bank and adjacent areas. Mean lengths, after separating sexes, were used to estimate growth and reproductive cycles.

*MESNIL B / ATLANTIC / GROWTH / REPRODUCTION / L PEALEI / I ILLECEBROSUS / ASSESSMENT / TRAWL


Investigation of L. opalescens as prey for marine mammals, fishes and seabirds, from stomach contents analyses. Comparisons of various food categories were made using an index of relative importance. Food webs are presented. Energy requirements and food utilization was determined for sooty shearwaters.


Based on length frequency distributions, four modal classes were found. Winter and spring migrations corresponded to different developmental patterns. In Japanese with English Abstract and Figure captions.

*MURAKAMI K / WATANABE Y / NAKATA J / PACIFIC / DISTRIBUTION / GROWTH / MIGRATION / O BARTRAMII


Report of the distribution and biology of Doscidicus gigas, from collections made by a Soviet research vessel during 1958. Concentrations of giant squid were densest from the equator to 18°S and up to 250 miles
offshore. This paper presents regressions of mantle length on upper beak length, diet, fecundities, reproductive structures, mating and growth. Squid ate mainly myctophids. Sizes at age were: 20-35 cm (one year), and 30-50 cm (two years), while larger squid were three to four years old.


(Provided by F. G. Hochberg, Museum of Natural History, Santa Barbara, Ca.)

Description of gonatid morphologies, which suggests diphyletic taxonomic structure.


Zoogeography of 41 cephalopod species collected off South and Central America on two Soviet research cruises during 1967 and 1968. Only three of 37 oceanic cephalopods were not tropical species. Based on collections and other published works, the report delineated 13 epipelagic, epimesopelagic and mesopelagic species, and 22 mesobathypelagic, bathypelagic and bathyabyssal species.


Collection of 41 cephalopod species during two Soviet research cruises. Of 37 oceanic species, 27 were tropical or tropical-subtropical, two were cosmopolitan and two were known from the Atlantic. Zoogeography, vertical distribution, reproduction, fecundity and larval development are discussed. In Russian with English abstract. (See Nesis (1972) for English presentation of similar, but reduced, content).

Systematics and diversity of gonatid squids. Diversity is highest in boreal Pacific waters. Gonatids are found in the tropics only in relatively cold waters off western America.


Investigation of the population structure of S. oualaniensis to test the hypothesis that two forms live in the central Indo-Pacific. Gear used in the 1975 research cruises were lights, jigs, cast nets, Isaacs-Kidd trawls (for larvae), and otter trawls. Report concluded that there exists a large late-maturing form, and a smaller early-maturing form (not found in the eastern Pacific). Mantle lengths, sex, maturity, stomach contents and morphology (spinal photophore) were measured. Principal food were myctophids and their own juveniles.


Report of collections of squids from the western tropical Pacific, using Isaacs-Kidd midwater trawls (for meso- and bathypelagic species), and nets, jigs and trawls (for epipelagic squids). Zoogeographical complexes were widely tropical, strictly tropical (equatorial and central), equatorial central and non-tropical. Differences with ETP fauna were attributed to species impoverishment in the eastern Pacific.


Caribbean and Gulf of Mexico, and ETP cephalopod fauna were found to have a high degree of similarity (28 common species). However, ETP nektobenthic and nerito-oceanic fauna were depauperate compared with Atlantic areas. Full lists of fauna were published in Tr. Inst. Okeanol. Akad. Nauk SSSR, 1975, 100:274-280, 285-286.

Title translates: Short Identification Keys to Cephalopods of the World's Oceans. Book is a cephalopod monograph which contains many illustrations useful in identifying squids. In Russian.


Report of the effectiveness of color, material and size of jigs, and diameter and condition of monofilament line on jigging for squid. Red and orange jigs worked best, while green and fluorescent ones were poorest. 1.17 mm diameter line fished less efficiently than 0.84 mm line (in a catch ratio of 1:2), and chafing of lines reduced fishing efficiency to half after four days.


Review of the use of light attraction for fishing, with jigging gear, for Todarodes pacificus. Results showed that squid congregated 20-25 m below the vessel in a dark zone, and attacked jigs in the boundary between light and dark. Comparisons showed mercury vapor lamps to have better performance than incandescent lights. Squid lower limit of light sensitivity was reported to be 0.1 lux.


Survey of 28 species of oegopsid cephalopods, sampled by 5' X 5' micronekton net tows, from Mexico to Chile as far west as 126°W. Numbers of specimens, descriptions, and distribution of species are discussed.


Worldwide geographic survey of cephalopods fished by Japan, as well as promising catchable stocks. Report reviews population assessments of most commonly fished species.

Comprehensive information of cephalopod resources, from worldwide sources. Contains color plates useful for identification purposes and 104 species are illustrated. In Japanese.


Survey of squid larvae collected during CalCOFI cruises of 1954-1957, captured using a one meter diameter net. Techniques used may not have accurately estimated species abundance and diversity. Report gives the systematics, description and distribution of 13 squid species.


Description of larval forms, growth, reproduction, food habits, parasites and commercial fishing of S. oualaniensis.


A survey of Pacific bonito stomach contents, collected during 1968 and 1969 at San Pedro, California. In order of abundance, principal prey were northern anchovy, other fish and Loligo opalescens.


Two methods of estimating food consumption are presented, one which
utilizes an energy budget model and the other which estimates daily food intake based on instantaneous gastric evacuation rates. In 1972, a major food source of ETP yellowfin tuna was frigate tunas (Auxis sp.), and cephalopods ranked second, according to an index of relative importance using volumes, occurrences and numerical abundances. However, in terms of mean prey biomass based on daily food intake, cephalopods ranked fourth, after scombrids, nomeids and gonostomatids.

*3 OLSON R J / ETP / FISH / FEEDING HABITS / PURSE SEINE


Examination of 15 cephalopod species showed infections of digenetic trematodes. Paper reviews literature and includes a list of cephalopods which have been reported to have infections.

*6 OVERSTREET R M / HOCHBERG F G / PARASITE / S OFFICINALIS / A FALCO / A FELIS / L CHIROCTES / P GEMMATA / P GIARDI / J HEATHI / D GIGAS / L BREVIS / ROSSIA / O BRIAREUS / O MAORUM


Comparisons of similarities between cephalopods and fish. Description and review of cephalopod biology (habitat, locomotion, feeding, growth, sensory organs, and paleontology).


Report of pelagic cephalopods caught in nighttime trawl surveys, during 1961-1963 off the Oregon coast. Gonatus spp., Abraliopsis sp. and Chiroteuthis sp. were most abundant numerically. Cephalopod avoidance of trawl gear and comparisons of survey results with albacore food habits were discussed.


Application of the regression equations of Love (1977) to predict acoustic target strengths from body lengths of marine organisms. Data
Population dynamics of octopus found off northwest Africa, from four cruises 1967-1978, and based on mantle length frequency distributions. In 1976, the contribution of octopus to the commercial catch of cephalopods from the Saharan Bank was 49%. Growth, length-weight relationships and production models are discussed. In Spanish with English summary.

Survey of tuna and porpoise stomach contents from animals captured by tuna purse-seine, in six net hauls in the eastern tropical Pacific, during April 1968. Dosidicus gigas and Symplectoteuthis sp. were the most abundant squids found, and squid were most important in terms of co-occurrences between tuna and porpoise, and as food for porpoise. While porpoise fed on both mesopelagic squid and epipelagic squid, tuna did not eat mesopelagic squid.

Investigation of the scattering layer off Southern California to determine euphausiid biomass. Accuracy of acoustic estimation was a function of concentration and size or weight of the organisms, and depth of the layer.

Experimental jigging for Atlantic Ocean Illex illecebrosus, with one automatic and two hand operated jigging machines. Squid catches varied from 40 to 1,200 pounds per hour of 18-25 cm mantle length squid. Even in full moon conditions catches were 1,000+ pounds per hour.

*5 RATHJEN W F / STANLEY D W / LIGHTS / JIGGING / ATLANTIC


Analyses of carbon isotopes in two Pacific ocean ecosystems, one in the ETP and the other in the Southern California Bight. Results indicate that the ratio of carbon-13 to carbon-12 increases with increasing trophic level. ETP Symplectoteuthis oualaniensis ratios were above zooplankton, and below those of flying fish, frigate tunas and sharks.

*3 RAU G H / MEARNS A J / YOUNG D R / OLSON R J / SCHAFER H A / KAPLAN I R / SQUID DIET / FISH / FEEDING HABITS / ETP / EASTPACIFIC / S OUALANIENSIS / MARINE MAMMALS


Examination of the stomach contents of 1097 yellowfin tuna caught by trolling, live bait pole-and-line fishing, and longline, in waters near the Line and Phoenix Islands. Food categories, by volume, were fish (47%), squid (26%) and crustaceans (25%). Unidentified squid, crab larvae and carangid fish were the three most important food items of yellowfin, by volume. Comparisons of stomach contents were made by size of predator and distance to land.

*3 REINTJES J W / KING J E / FISH / FEEDING HABITS / PACIFIC / LINE / LONGLINE / O BANKSII / S OUALANIENSIS / OCTOPODOTEUTHIDAE / OCTOPODA


Information of seven cetacean species included cephalopods eaten by 54 sperm whales and seven giant bottlenose whales. Squid occurred in 96% of sperm whale stomachs.

*3 RICE D W / EASTPACIFIC / MARINE MAMMALS / FEEDING HABITS / M ROBUSTA / G BOREALIS / ONYCHOTEUTHIS / OCTOPUS / G FABRICII

Report of a collection of 30 species of decapods, mainly from the eastern tropical Pacific Ocean, near the Galapagos Islands. The majority were juvenile forms.

*2 ROBSON G C / NET / LIGHTS / TRAWL / ETP / ATLANTIC / B ABYSSICOLA / BATHYTEUTHIS / A HOYLEI / ABRALIOPSIS / P GIARDI / O NIELSEN / ONYKIA / O BANKS / H OCEAN / S PTEROPUS / STENOTEUTHIS / CHIROTEUTHIS / H PELAGICA / MASTIGOTEUTHIS / L REINHARDTI / GALITEUTHIS / T PACIFICUS / H BEEBEI


Delineation of tentacular club areas (dactylus, manus and carpus) for seven ommastrephid squids.

*1 ROELEVELD M A / IDENTIFICATION / S OUALANIENSIS / O BARTRAMII / N GOULDI / T PACIFICUS / S PTEROPUS / N SLOANI PHILIPPINENSIS


Comparisons of captures between several types of trawls. Trawls used were Isaacs-Kidd midwater trawl (IKMT), rectangular midwater trawl (RMT), and Engel trawl (EMT). Because the IKMT and RMT were closing types, some depth comparisons were also made. Indices of similarity (Jaccard's Community Index and Index of Similarity) indicated dissimilarity in net sampling between types.

*7 ROPER C F E / TRAWL / ASSESSMENT / ATLANTIC


A dichotomous key using external body characteristics, with illustrations of representative species in 25 families. Includes notes on each family.


A report on the vertical distribution and vertical migration of pelagic cephalopods, presented by records of representative species in each family and summarized in bar graphs. Scope is worldwide with data from California, Bermuda, Hawaii and other collections.


Paper which describes chemicals and techniques used to fix and preserve cephalopods. In addition to describing of the use of formalin and alcohol, the authors discuss methods of freezing, extraction of beaks, statoliths and radulae, rehydration, labelling and containing.

*6 ROPER C F E / SWEENEY M J / PRESERVATION


Descriptions of and keys to the identification of 125 octopod and decapod cephalopods. Drawings of key morphological features are included. Distributions given include areas outside Japanese waters.

*1 SASAKI M / IDENTIFICATION / PACIFIC / EASTPACIFIC / ATLANTIC / INDIAN / DISTRIBUTION / OCTOPODA / ARCHITEUTHIDAE / OMMASTREPHIDAE / THYSANOTEUTHIDAE / HISTIOTEUTHIDAE/ CHIROTEUTHIDAE / ONYCHOTEUTHIDAE / ENOPLOTEUTHIDAE / GONATIDAE / CRANCHIDAE / LOLIGINIDAE / SEPIIDAE / SEPIOLIDAE / IDOSEPIIDAE / PROMACHOTEUTHIDAE


A report of jigging for D. gigas off the Baja California coast, near Manzanillo and in the Gulf of California, during October-December 1971, off the Japanese research vessel Ryoun-Maru No. 3. Most of the catch were squid over 300 mm mantle length, and estimated life span was one year. Catches were 23280 kg in October, 728 kg in November and 30 kg in December.

*7 SATO T / ETP / D GIGAS / JIGGING / DISTRIBUTION / SQUID DIET / FISH FEEDING HABITS / MARINE MAMMALS / GROWTH / REPRODUCTION

Similar to Sato (1975a). Investigation of the resource potential of Doscidicus gigas, conducted from August 1971 to January 1972, off Baja California, in the Gulf of California and off Manzanillo, from the vessel Gyoun Maru.


Composition of prey (fish and squid) of the Blue-faced Booby, the Red-faced Booby and the Great Frigatebird. Results seem to indicate a partitioning of the food resource by prey size and type.


Study of optical ganglion cholinesterases, which showed little differences between South Atlantic and western Pacific Ommastrephes bartrami. Report suggests that the squid populations are not genetically separated.

Echo-sounder recordings of Ommastrephes sloani pacificus, using 28, 50 and 200 kHz sounders, from vessels both underway and stationary. In addition, an underwater camera transmitted videos of squid responses to jigging lures.


Measurements and calculations for measuring squid targets using a 50 kHz sounder. Although echotraces from squids could not be clearly identified, the sounder could detect individual squid at a maximum depth of 20-30 meters.


Note on the stomach contents of a male Stenella attenuata captured three miles off Oahu. Pelagic squid were the most abundant food (86% by volume), and second were myctophids (6%).


Presentation of simulation of fishing Loligo pealei and Illex illecebrosus of the east coast of the US. The simulation model used modified (for growth and spawning) yield equations and a Beverton-Holt stock recruitment relationship.


Similar to Spratt (1979). See annotation for content.


Growth rates of Loligo opalescens were determined from statoliths and compared with model length progressions. Both statolith growth rings and...
Length composition showed that the squid reach adult size in about 14 lunar months, and that slower growing squid can live through part of a second season.

*6 SPRATT J D / L OPALESCENS / EASTPACIFIC / GROWTH / AGING


Assessment of coastal California fish stocks, from observations by commercial fish spotters, using night (bioluminescence) and day (color and light intensity) sightings. Most common species seen were northern anchovy, jack mackerel, Pacific bonito, Pacific mackerel, Pacific Sardine and bluefin tuna. Squid (Loligo opalescens) were among the less common observations, but distributions of sightings are presented.

*7 SQUIRE J L / L OPALESCENS / AIRPLANE / DISTRIBUTION / EASTPACIFIC / ASSESSMENT


Report of surveys for shrimp, squid, and fish normally taken by shrimp trawls. An estimate of the total shrimp fleet catch of the squid Lolliguncula panamensis was 150,000 kg.

*7 SQUIRES H J / MORA O / BARONA O / ARROYO O / L PANAMENSIS / TRAWL / ETP


Growth, reproduction, feeding habits, and estimation of stock potential of the squid Lolliguncula panamensis. Report was based on a survey of commercial shrimps and fishes along the Pacific coast of Columbia, mainly from depths of 5 to 30 m.

*7 SQUIRES H J / BARRAGAN J H / L PANAMENSIS / ETP / TRAWL / SQUID DIET / ASSESSMENT / IDENTIFICATION / GROWTH / REPRODUCTION


Prey were epipelagic and mesopelagic fishes and cephalopods, but most likely mesopelagic prey were eaten near the surface, after vertical migration in response to reduced light at dusk.

*3 STROUD R K / FISCUS C H / KAJIMURA H / EASTPACIFIC / MARINE MAMMALS / FEEDING HABITS / L OPALESCENS / ABRALIOPSIS / OCTOPOTEUTHIS / GONATUS / G BOREALIS / O BOREALIJAPONICUS / CHIOTEUTHIS / CRANCHIIDAE / O TUBERCULATA

Report on the abundance of Ommastrephes sloani pacificus in the Hokkaido, Japan area. Optimum temperature and prey availability were considered to be the major controls of squid migration and population density. Indices of abundance were based on catch per unit effort; prey availability was correlated with the deep scattering layer; and, temperature was observed as a function of current zones.

*7 SUZUKI T / O SLOANI PACIFICUS / PACIFIC / ASSESSMENT / JIGGING / DISTRIBUTION / SQUID DIET


A brief summary of echosounding techniques used in locating T. pacificus and a technique for estimating school size by monitoring decreasing CPUE. Squid were located more effectively using 200 kHz than with lower frequencies, and were found between the upper and lower deep scattering layers, formed by thermoclines. The relation of CPUE and cumulative catch allowed estimation of squid numbers, which can then be related to echosounding patterns.

*7 SUZUKI T / SONAR / ASSESSMENT / T PACIFICUS / PACIFIC


Echo-traces of pelagic Todarodes pacificus showed that squid images and the deep scattering layer are more clearly recorded using a 200 kHz sounder than with a 75 kHz one. Squid school images appeared spindle shaped, at a ship's speed of 9 knots, and were generally distributed between the upper and lower scattering layers.

*7 SUZUKI T / TASHIRO M / YAMAGISHI Y / SONAR / ASSESSMENT / VERTICAL / JIGGING / T PACIFICUS


A useful review of squid pens, for identification purposes.

*6 TOLL R B / IDENTIFICATION

A food habits study in which fish was the primary prey item. Squid and crustaceans were also food items. In Chinese with English abstract. *6 TUNG I / PACIFIC / S OUALANIENSIS / SQUID DIET / PARASITE


Target strengths, from eleven individual squid and using a 200 kHz sounder, showed little relation to the size of squid. Values can be used in integrator systems applicable to population assessment. *7 VAUGHAN D L / L OPALESCENS / ASSESSMENT / SONAR


Similar to Vaughan and Recksiek (1979). See annotation for content. *7 VAUGHAN D L / RECKSIEK C W / L OPALESCENS / SONAR / ASSESSMENT / EASTPACIFIC


Echo-traces of squid, recorded by sounders operating at 38, 50 and 200 kHz, were verified by midwater trawls, jigging and visual observation. Two behavioral patterns were observed, one from continuous bottom associated traces, and the other from more difficult to assess midwater plume traces. *7 VAUGHAN D L / RECKSIEK C W / L OPALESCENS / SONAR / ASSESSMENT / EASTPACIFIC

Notes on the distribution of baleen and sperm whales in the ETP. Baleen whales were found in areas of richer food bases, connected with zones ofvergence, and such distribution was atypical of migrating whales. Report says surface observations of squid, and convergence zones cannot always be associated with sperm whale distributions, since these whales feed on deep water prey.

*3 VOLKOV A F / MOROZ I F / MARINE MAMMALS / FEEDING HABITS / ETP


Depth distribution of major taxa, including specific examples. Zones described are the epipelagic, mesopelagic, bathypelagic, thathyepelagic and benthic.

*2 VOSS G L / VERTICAL / TRAWL / SQUID DIET


Report of the collection of 18 cephalopod species in the Gulf of Panama, of which eight were squids and four were new octopus species. Records of collection sites and methods (lights, trawls, nets, and dipnets) are included.

*2 VOSS G L / ETP / DIPNET / LIGHTS / NET / VERTICAL / FISHING / DISTRIBUTION / L DIOMEDEA / O BANKSII / P GIARDI / A AFFINIS / L PANAMENSIS / B BACIDIFERA / D GIGAS / MASTIGOTEUTHIS / D DANAE / V DANAE / B ABYSSICOLA / S OUALANIENSIS / HISTIOTEUTHIS / M DENTATA / OCTOPODA / TRAWL


A survey of worldwide cephalopod resources, fisheries, and potential. Report is compiled by specific countries or areas.

*2 VOSS G L / WORLDWIDE / ETP / EAST PACIFIC / PACIFIC / FISHING / ATLANTIC / INDIAN / MEDITERRANEAN / DISTRIBUTION / L OPALESCENS / L DIOMEDEA / L PANAMENSIS / L BREVIS / S OUALANIENSIS / D GIGAS


Contains a food habits section with stomach contents of nine coastal and 17 offshore ETP Tursiops. ETP dolphin prey were, by volume, epipelagic fish (86.7%), and cephalopods (13.3%). Report suggests that mesopelagic fish remains in dolphin stomachs occurred secondarily, because stomach
contents of an intact Doscidicus gigas included otoliths from mesopelagic fishes.

*3 WALKER W A / ETP / EASTPACIFIC / MARINE MAMMALS / FEEDING HABITS / SQUID DIET / L OPALESCENS / D GIGAS / O BIMACULATUS / A AFFINIS / S OUALANIENSIS / T RHOMBUS / HISTIOTEUTHIS / OCTOPOTEUTHIS / CHIROTEUTHIS CRANCIIDAE / O TUBERCULATA


Examination of 707 skipjack stomach contents, from tuna obtained by live bait fishing, longline, trolling and purse seine, from 1950 to 1956. Food categories, by volume, were fish (74.6%), squid (19.5%), and crustaceans (3.7%).


Review of hydroacoustic estimation and its application to the assessment of squid abundance. Transmission, noise, computerization, and applications are discussed. Commercial trawling techniques are also presented.

*7 WAWROWSKI R / SONAR / ASSESSMENT / TRAWL


Sampling Loligo sp. and Illex illecebrosus, with groundfish and other bottom trawls, indicated that squid abundance south of Cape Hatteras is small relative to more northern waters. Length frequency and seasonal data are presented.

*7 WHITAKER J D / ASSESSMENT / TRAWL / SEASONAL / ATLANTIC / GROWTH / L PEALEI / L PLEI / I ILLECEBROSUS


Methods for identifying eight common squids of the ETP, by the use of upper and lower beak dimensions. Author presents linear regressions of mantle length and body weight on beak dimensions.

*1 WOLFF G A / ETP / IDENTIFICATION / D GIGAS / O BARTRAMI I / O BANKSII / A AFFINIS / P GIARDI / L REINHARDT I / L OPALESCENS / S OUALANIENSIS / MORPHOMETRICS

Study of beak characteristics of 18 squid species, and application of resulting beak identification guide to stomach content analysis of Stenella attenuata and Thunnus albacares (same collection as Perrin et al. 1973). Reviews papers on tuna and cetacean feeding habits. Cephalopod beak key was based on ANOVA using 31 ratios of upper and lower beak dimensions. Presents linear regressions of squid body weight on mantle length and upper and lower rostral lengths. Grouping of tuna and dolphin stomach contents was based on discriminant analysis and clustering, and theories of feeding strategies are presented.


Use of discriminant analysis and multiple linear regression to separate two Atlantic squids, Ommastrephes pteropus and O. bartrami, on the basis of ratios of upper and lower beak dimensions. Discriminant analysis classified 42 of 46 samples correctly; multiple linear regression used two and three variables. Regressions of weight and mantle length on rostral length were presented.


Dissertation in which morphological characters and clustering, recurrent group analysis and factor analysis were used to distinguish 12 ommastrephid squids. The resulting taxonomic structure placed Symplectoteuthis oualaniensis and Ommastrephes pteropus into the genus Symplectoteuthis, whereas S. luminosa and Hyaloteuthis pelagica were put in the genus Hyaloteuthis. Author includes species descriptions and notes on ecology, distribution and feeding habits.

*1 WOLFF G A / FISH / MARINE MAMMALS / FEEDING HABITS / PACIFIC / ETP / S OUALANIENSIS / D GIGAS / O BARTRAMII / L DANAЕ / S LUMINOSA / N HAWAIENIСIS PACIFICUS / H PELAGICA / O VOLATILIS / L REINHARDTI / A AFFINIS / A FELIS / P GIARDI / H HETEROPSIS / H DOFLEINI / G ONYX / L OPALESCENS / O BANKSII / IDENTIFICATION / MORPHOMETRICS

*1 WOLFF G A / WORMUTH J H / IDENTIFICATION / MORPHOMETRICS / ATLANTIC / O PTEROPUS / O BARTRAMII


Publication of the same information presented in author's PhD dissertation (Wormuth 1971). In addition, ommastrephid biogeography is discussed in more depth.


A short history and description of jigging gear used to catch Todarodes pacificus.


A survey of juvenile cephalopods, from depth-discrete tows made to collect Japanese eel larvae, with a 2.5 m diameter net. Horizontal and vertical distributions are presented for 23 larval squid species.

YANAMOTO K / OKUTANI T / IDENTIFICATION / PACIFIC / NET / DISTRIBUTION / VERTICAL / ROSSIA / ENOPLOTEUTHIS / A ANDAMANICA / ABRALIA / T ALESSANDRINII / P GIARDI / OCTOPOTEUTHIS / O BOREALIJAPONICUS / O CARRIBAEa / C SICULUS / L PACIFICA / L REINHARDTI / L VALDIVIAE / GALITEUTHIS / S MELANCHOLICUS / TEUTHOWENIA


Description of 33 cephalopod species, collected from 28°N to 34°N by an Isaacs-Kidd mid-water trawl. Includes a key to these species, and discusses characters, systematics and distribution. Contains 38 plates of illustrations.


Trawl survey of the squid Leachia pacifica, off Oahu, Hawaii. Larvae to young adults were found in near surface waters; but, mature animals occurred at depths greater than 1000 m. Branchial photophores probably serve as sexual attractants.


A short summary of the biology of Symplectoteuthis oualaniensis, which occurs in the tropical Pacific and Indian Oceans. Report states although little is known about this squid's biology and vertical distribution, seabirds feed upon it, and its abundance indicates it may be an untapped ocean resource.


A study of six midwater squids, to investigate if counterillumination could serve as a concealment behavior at upper depths. Paper presents vertical distributions (from day and night trawls), countershading behavior, and data on bioluminescent organs. Bioluminescent countershading was believed to occur in four of the six species.


Survey of the vertical distribution of 47 cephalopod species, which revealed habitat separation among related species, and reported day-night migrations in 25 of the 47 species. Reproductive processes were linked to vertical zonation. Size and shape of photosensitive vesicles were associated with detection of downwelling light and regulation of vertical migration and counterillumination.

Investigation of counterillumination in three mesopelagic squids and one myctophid fish. Counterillumination responses occurred under an upper limit of light intensity. Intensity limits were correlated with moonlit night and day illumination, at depth, and with trawl survey data. Counterillumination was thought to be a concealment behavior at upper depth limits.


Comprehensive work covering squid resources, based on a survey of worldwide literature and the authors' own data. Topics covered include form and structure, growth and reproduction, feeding, distribution, biological review by major genera and species, and fishing methods and production.


Presentation of characteristics of some ommastrephid squids, and some suggestions related to their taxonomic positions. In Russian with English summary.
References are listed by broad taxonomic groups. Literature may deal with either one of the species listed or a broader taxa (genus, family, or order).

TEUTHOIDEA

Architeuthidae:
Architeuthis

Anonymous 1982a
Belyayev 1962
Clarke 1962, 1980
Gaskin and Cawthorn 1967
Hess and Toll 1981

Morejohn et al. 1978
Packard 1972
Roper et al. 1969
Sasaki M. 1929

Bathyteuthidae:
Bathyteuthis abyssicola, B. bacidifera, B. berryi, Benthoteuthis

Fields and Gauley 1972
Herring 1977
Hoyle 1904
King and Iversen 1962
Nesis 1973a
Okutani 1974

Robson 1948
Roper et al. 1969
Roper and Young 1975
Voss 1971
Young 1972

Brachioteuthidae:
Brachioteuthis riisei

Iversen 1962
King and Iversen 1962
Nesis 1973a

Okutani 1974
Roper et al. 1969
Young 1978

Chiroteuthidae:
Chiroteuthis calyx, C. imperator, C. picteti, C. veranyi, Doratopsis, Planktoteuthis lippula, Valbyteuthis danae, V. Obligobessa

Clarke 1962, 1980
Clarke et al. 1976
Clarke and Kristensen 1980
Fiscus 1982
Fiscus and Mercer 1982
Harris 1973
Kawakami 1980
King and Iversen 1962
McGowan 1967
McHugh 1952
Nesis 1972, 1973a
Okutani 1974

Okutani and McGowan 1969
Pearcy 1965
Perrin et al. 1973
Robson 1948
Roper et al. 1969
Roper and Young 1975
Sasaki 1929
Stroud et al. 1981
Voss 1971
Walker 1981
Young 1972, 1978
Cranchiidae:

Alverson 1963
Anonymous 1982a
Belyayev 1962
Blackburn 1968
Clarke 1962, 1966, 1980
Clarke and Stevens 1974
Clarke et al. 1976
Clarke and Kristensen 1980
Fields and Gauley 1972
Herring 1977
Hess and Toll 1981
Hoyle 1904
Iversen 1962
Iversen 1971
Iversen and Pinkas 1971
Kawakami 1980
King and Ikehara 1956
King and Iversen 1962

McGowan 1967
McHugh 1952
Morejohn et al. 1978
Nesis 1972, 1973a, 1978
Okutani 1974
Okutani and McGowan 1969
Packard 1972
Pearcy 1965
Pinkas 1971
Robson 1948
Roper et al. 1969
Roper and Young 1975
Stroud et al. 1981
Voss 1971
Walker 1981
Wolff 1982a, 1982b
Yanamoto and Okutani 1975

Ctenopterygidae:
Ctenopteryx siculus

Blackburn 1968
Hess and Toll 1981
King and Iversen 1962
Nesis 1972, 1973a
Okutani 1974

Okutani and McGowan 1969
Packard 1972
Roper et al. 1969
Yanamoto and Okutani 1975
Young 1978

Cycloteuthidae:
Cycloteuthis sirventi, Discoteuthis discus, D. lacniosa

Clarke 1980
Kawakami 1980
Nesis 1973a

Roper et al. 1969
Young 1978

Enoplostueuthidae:

Alverson 1963
Anonymous 1982a

Ashmole and Ashmole 1968
Ashmole and Ashmole 1967
Enoploteuthidae (continued):

- Blackburn 1968
- Clarke 1966, 1980
- Clarke et al. 1976
- Fields and Gauley 1972
- Fiscus 1982
- Hanlon et al. 1979
- Harris 1973
- Herring 1977
- Hess and Toll 1981
- Hoyle 1904
- Iversen 1962
- Iversen 1971
- Iversen and Pinkas 1971
- Kawakami 1980
- King and Ikehara 1956
- King and Iversen 1962
- Kubodera and Okutani 1981
- McGowan 1967
- McGowan and Okutani 1968
- McHugh 1952

- Morejohn et al. 1978
- Nesis 1972, 1973a
- Okutani 1974
- Okutani and McGowan 1969
- Overstreet and Hochberg 1975
- Packard 1972
- Pearcy 1965
- Perrin et al. 1973
- Pinkas 1971
- Robson 1948
- Roper et al. 1969
- Sasaki 1929
- Shomura and Hida 1965
- Stroud et al. 1981
- Voss 1971
- Walker 1981
- Wolff 1982a, 1982b
- Yanamoto and Okutani 1975
- Young et al. 1980

Gonatidae:

- Berryteuthis magister, Gonatopsis borealis, Gonatus anonychus, G. antarcticus, G. bernyi, G. californiensis, G. fabricii, G. madokai, G. magister, G. onyx, G. pyros

- Anonymous 1982a
- Belyayev 1962
- Bernard 1980
- Berzin 1971
- Clarke and Stevens 1974
- Clarke et al. 1976
- Clarke and Kristensen 1980
- Clarke and MacLeod 1980
- Dawe 1981
- Fiscus 1982
- Fiscus and Mercer 1982
- Iversen 1971
- Iversen and Pinkas 1971
- Jefferts and Pearcy 1979
- Kawakami 1976, 1980
- Kawamura 1980
- Kristensen 1980
- Kubodera and Okutani 1981
- Laevastu and Larkins 1981
- Matsumoto 1982
- McGowan 1967
- McHugh 1952
- Okutani 1977
- Okutani and McGowan 1969
- Pearcy 1965
- Pinkas 1971
- Rice 1963
- Roper et al. 1969
- Roper and Young 1975
- Sasaki 1929
- Stroud et al. 1981
- Wolff 1982b
- Young 1972

Grimalditeuthidae:

- Grimalditeuthis bomplandii

- Roper et al. 1969
- Young 1972, 1978
Histioteuthidae:

Anonymous 1982a
Belyayev 1962
Blackburn 1968
Clarke 1962, 1980
Clarke and Stevens 1974
Clarke et al. 1976
Clarke and Kristensen 1980
Gaskin and Cawthorn 1967
Harris 1973
Herring 1977
Hess and Toll 1981
Hoyle 1904
Iverson 1971
Iverson and Pinkas 1971
Kawakami 1976, 1981
King and Iversen 1962

Morejohn et al. 1978
Nesis 1972, 1973a
Okutani 1974
Okutani and McGowan 1969
Packard 1972
Pearcy 1965
Perrin et al. 1973
Robson 1948
Roper et al. 1969
Roper and Young 1975
Sasaki 1929
Voss 1971
Walker 1981
Wolff 1982b
Young 1972, 1977, 1978

Lepidoteuthidae (Pholidoteuthidae): Lepidoteuthis, Pholidoteuthis adami, Tetronychoteuthis massyae

Anonymous 1982a
Clarke 1980
Harris 1973
Hess and Toll 1981

Kawakami 1980
Matsumoto 1982
Roper et al. 1969

Loliginidae:

Ally and Keck 1978
Alversen 1963
Amaral and Carr 1980
Ashmole and Ashmole 1967
Bernard 1980
Berry 1912
Blott 1980
Boletzky 1977
Calliet et al. 1979
Christofferson et al. 1978
Clark and Brown 1979
Clarke 1962
Court 1980
Dawe 1981

Dewees and Price 1983
Engel 1975
Evans 1975
FAO 1982
Fields 1965
Filippova 1971
Fiscus 1982
Gaskin and Cawthorn 1967
Grieb and Beeman 1978
Hanlon et al. 1979
Herring 1977
Hochberg and Fields 1980
Hoyle 1904
Huey 1930
Hurley 1978
Loliginidae (continued):

Iversen 1962
Iversen 1971
Iversen and Pinkas 1971
Juanico 1980, 1982
Karpov and Calliet 1978, 1979
Kashiwada and Recksiek 1978
Kashiwada et al. 1979
Kato and Hardwick 1975
King and Ikehara 1956
Knipe and Beeman 1978
Koyama 1975
Lange 1980
Lange and Sissenwine 1980
Laughlin and Livingston 1982
Matsui et al. 1972
Matsumoto 1982
McGowan 1954, 1967
McHugh 1952
McInnis and Broenkow 1978
Mearns et al. 1981
Mesnil 1977
Morejohn et al. 1978
Nesis 1973a, 1978
Okutani 1977
Okutani and McGowan 1969
Oliphant 1971
Overstreet and Hochberg 1975
Packard 1972
Pearcy 1965
Pinkas 1971
Roper et al. 1969
Sasaki 1929
Sato 1975b
Sissenwine and Tibbetts 1977
Spratt 1978, 1979
Squire 1983
Squires et al. 1971
Squires and Barragan 1979
Stroud et al. 1981
Vaughan 1978
Vaughan and Recksiek 1978, 1979
Voss 1971, 1973
Waldron and King 1963
Walker 1981
Whitaker 1980
Wolff 1982a, 1982b

Mastigoteuthidae:
Mastigoteuthis dentata, M. famelica, M. inermis, M. pyrodes

Anonymous 1982a
Clarke 1980
Clarke and Trillmich 1980
Hoyle 1904
Iversen 1971
Iversen and Pinkas 1971
King and Iversen 1962
Nesis 1973a
Okutani 1974
Robson 1948
Roper et al. 1969
Roper and Young 1975
Voss 1971
Young 1972, 1978

Neoteuthidae:
Neoteuthis

Okutani 1974
Roper et al. 1969
Young 1972

Octopoteuthidae (Octopodoteuthidae):
Octopoteuthis (Octopodoteuthis) deletron, Taningia danae

Anonymous 1982a
Belyayev 1962
Blackburn 1968
Clarke 1962, 1980
Clarke and Stevens 1974
Clarke et al. 1976
Clarke and Kristensen 1980
Fiscus 1982
Harris 1973
Herring 1977
Kawakami 1980
King and Iversen 1962
Octopoteuthidae (continued):

McGowan 1967
McHugh 1952
Morejohn et al. 1978
Okutani 1974
Okutani and McGowan 1969
Reintjes and King 1953

Roper et al. 1969
Roper and Young 1975
Walker 1981
Yamamoto and Okutani 1975
Young 1972

Ommastrephidae:
Dosidicus (Ommastrephes) gigas, Hyaloteuthis pelagica, Illex argentinianus, I. illecebrosus, Nototodarus gouldi, N. (Ommastrephes) hawaiiensis, N. sloani, N. sloani gouldi, N. sloani philippinensis, Ommastrephes bartramii, O. caroli, O. (Symplectoteuthis) pteropus, (O.) sloani pacificus, Ornithoteuthis antillarum, O. volatilis, Symplectoteuthis (Tucaneoteuthis) luminosa, S. oualantensis, Stenoteuthis, Todarodes angolensis, T. filippovae, T. pacificus, T. sagittatus, Todaropsis eblanau

Alverson 1963
Ashmole and Ashmole 1968
Ashmole and Ashmole 1967
Balch et al. 1978
Bernard 1980
Bernard 1981
Berry 1912, 1914
Berzin 1971
Blackburn 1968
Blunt 1960
Boletzky 1977
Burukovski et al. 1977
Clark and Brown 1979
Clarke and Stevens 1974
Clarke et al. 1976
Clarke and Kristensen 1980
Clarke and Trillmich 1980
Court 1980
Dawe 1981
Dewees and Price 1983
Fields and Gauley 1972
Filippova 1971
Fiscus 1982
Fiscus and Mercer 1982
Flores et al. 1978
Gaevskaya 1976, 1977
Gaevskaya and Nigamutullin 1976
Gaskin and Cawthorn 1967
Hamabe et al. 1975
Hanlon et al. 1979

Harris 1973
Herring 1977
Hess and Toll 1981
Hochberg and Fields 1980
Hoyle 1904
Hurley and Waldron 1978
Hurley and Beck 1979
Iversen 1962
Iversen 1971
Iverson and Pinkas 1971
Japan Marine Fishery Resource Research Center 1978
Juanico 1960
Juhl 1955
Kawakami 1976, 1980
Kawamura 1980
King and Ikehara 1956
King and Iversen 1962
Klett Traulsen 1981, 1982
Korzn et al. 1979
Kubodera and Yoshida 1981
Lange 1980
Lange and Sissenwine 1980
Lee 1981
Lipinski and Wrzesinski 1982
Long and Rathjen 1980
Lu and Dunning 1982
Matsumoto 1982
McHugh 1952
Mearns et al. 1981
Mercer 1975
Mesnil 1977
Morejohn et al. 1978
Ommastrephidae (continued):

Murakami et al. 1981
Nesis 1970, 1972
1973a, 1977a, 1978
Ogura 1976
Ogura and Nasumi 1976
Okutani 1977
Overstreet and Hochberg 1975
Packard 1972
Perrin et al. 1973
Pinkas 1971
Rathjen and Stanley 1982
Rau et al. 1983
Reintjes and King 1953
Robson 1948
Roeleveld 1982
Roper et al. 1969
Roper and Young 1975
Sasaki 1929
Sato 1975a, 1975b
Shevtsova et al. 1977, 1979
Shibata and Flores 1972
Shomura and Hida 1965
Sissenwine and Tibbetts 1977
Suzuki 1963
Suzuki 1975
Suzuki et al. 1974
Tung 1976, 1981
Voss 1971, 1973
Waldron and King 1963
Walker 1981
Whitaker 1980
Wolff and Wormuth 1979
Wolff 1982a, 1982b
Wormuth 1971, 1975
Yajima and Mitsugi 1975
Young 1972, 1975b
Zuev et al. 1975

Onychoteuthidae:
Kondakovia, Moroteuthis robusta, Onychoteuthis banksii, O. borealijaponicus,
U. compacta, Onykia caribaea

Alverson 1963
Anonymous 1982a
Bernard 1980
Berry 1914
Berzin 1971
Blackburn 1968
Clarke 1962, 1966, 1980
Clarke et al. 1976
Clarke and Trillmich 1980
Evans 1975
Fiscus 1982
Fiscus and Mercer 1982
Gaskin and Cawthorn 1967
Harris 1973
Herring 1977
Hess and Toll 1981
Hochberg 1974
Hochberg and Fields 1980
Hoyle 1904
Iversen 1962
Iverson 1971
Iverson and Pinkas 1971
Jefferts and Pearcy 1979
Kawakami 1976, 1980
Kawamura 1980
King and Ikehara 1956
King and Iversen 1962
Matsumoto 1982
McGowan 1967
McHugh 1952
Morejohn et al. 1978
Nesis 1972, 1973a
Okutani 1974, 1977
Okutani and McGowan 1969
Packard 1972
Pearcy 1965
Perrin et al. 1973
Pinkas 1971
Reintjes and King 1953
Rice 1963
Robson 1948
Roper et al. 1969
Sasaki 1929
Stroud et al. 1981
Voss 1971
Wolff 1982a, 1982b
Yamamoto and Okutani 1975
Young 1972, 1978
<table>
<thead>
<tr>
<th>Taxon</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychroteuthidae:</td>
<td>Clarke et al. 1976, Kawakami 1980</td>
</tr>
<tr>
<td>Psychroteuthis</td>
<td>Roper et al. 1969</td>
</tr>
<tr>
<td>Thysanoteuthidae:</td>
<td>Alverson 1963</td>
</tr>
<tr>
<td></td>
<td>Morejohn et al. 1978, Okutani 1977, Roper et al. 1969, Sasaki 1929</td>
</tr>
<tr>
<td>OCTOPODA (Argonautidae, Octopodidae)</td>
<td></td>
</tr>
</tbody>
</table>
## VAMPYROMORPHA

### Vampyroteuthis infernalis

<table>
<thead>
<tr>
<th>Authors</th>
<th>Year(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarke</td>
<td>1980</td>
</tr>
<tr>
<td>Clarke et al.</td>
<td>1976</td>
</tr>
<tr>
<td>Clarke and Kristensen</td>
<td>1980</td>
</tr>
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<td>Iverson</td>
<td>1971</td>
</tr>
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<td>Iverson and Pinkas</td>
<td>1971</td>
</tr>
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<td>Kawakami</td>
<td>1980</td>
</tr>
<tr>
<td>Nesis</td>
<td>1973a</td>
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<td>Pearcy</td>
<td>1965</td>
</tr>
<tr>
<td>Young</td>
<td>1972, 1978</td>
</tr>
</tbody>
</table>

### SEPIOIDEA (Idosepiidae, Sepiidae, Sepiolidae)

#### Heteroteuthis hawaiensis, Rossia pacifica, Sepia officinalis

<table>
<thead>
<tr>
<th>Authors</th>
<th>Year(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anonymous</td>
<td>1981, 1982a</td>
</tr>
<tr>
<td>Boletzky</td>
<td>1977</td>
</tr>
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<td>Caddy</td>
<td>1981</td>
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<tr>
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<td>1962</td>
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<td>Clarke and Stevens</td>
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<td>FAO</td>
<td>1982</td>
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<td>1971</td>
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<td>Jefferts and Pearcy</td>
<td>1979</td>
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<td>King and Ikehara</td>
<td>1956</td>
</tr>
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<td>Koyama</td>
<td>1975</td>
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<tr>
<td>Morejohn et al.</td>
<td>1978</td>
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<td>Overstreet and Hochberg</td>
<td>1975</td>
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<td>Packard</td>
<td>1972</td>
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<td>Pearcy</td>
<td>1965</td>
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<td>Sasaki</td>
<td>1929</td>
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<td>Yanamoto and Okutani</td>
<td>1975</td>
</tr>
<tr>
<td>Young</td>
<td>1977, 1978</td>
</tr>
</tbody>
</table>
### Subject Index

#### Acoustic Techniques
- Amos and DeMello 1982
- Bernard 1980
- Blackburn and Thorne 1974
- Burczynski 1982
- Dewees and Price 1983
- Greenblatt 1981, 1982
- Greenlaw 1979
- Kanciruk 1982
- Kato and Hardwick 1975
- Kawaguchi and Nazumi 1972
- Love 1971
- Matsui and Kaneko 1972
- Penrose and Kaye 1979
- Pieper 1979
- Shibata and Flores 1972
- Shibata and Mashtawee 1980
- Suzuki 1975
- Suzuki et al. 1974
- Vaughan 1978
- Vaughan and Recksiek 1978, 1979
- Wawrowski 1981

#### Age Determination
- Dawe 1981
- Hurley and Beck 1979
- Kristensen 1980
- Spratt 1978, 1979

#### Airplane
- Squire 1983

#### Antarctic
- Beddington and May 1980
- Berzin 1971
- Clarke et al. 1980
- Filippova 1971
- Kawakami 1980
- Kawamura 1980
- Zuev and Nesis 1971

#### Arctic
- Clarke 1966

#### Assessment (sampling populations and determining abundances)
- Anonymous 1981
- Anonymous 1982a
- Arnold 1979
- Ashmole and Ashmole 1968
- Balch et al. 1978
- Belyayev 1962
- Blackburn 1968
- Blackburn et al. 1970
- Blackburn and Thorne 1974
- Burczynski 1982
- Calliet et al. 1979
- Clark and Brown 1979
- Clarke 1977, 1981
- Clarke and Brown 1979
- Clarke and Stevens 1974
- FAO 1982
- Greenblatt 1981, 1982
- Greenlaw 1979
- Hurley and Waldron 1978
- Japan Marine Fisheries Resource Research Center 1978
- Juanico 1982
- Kawaguchi and Nazumi 1972
- King and Iversen 1962
- Kubodera and Yoshida 1981
- Laevastu and Larkins 1981
- Lange 1980
- Lange and Sissenwine 1980
- Laughlin and Livingston 1982
- Long and Rathjen 1980
- Love 1971
- Matsumoto 1982
- Mercer 1975, 1981
- Mesnil 1977
- Nesis 1977a
- Okutani 1977
- Okutani and McGowan 1967
- Pearcy 1965
- Pereiro and Bravo de Laguna 1980
- Pieper 1979
- Roper 1977
<table>
<thead>
<tr>
<th>ASSESSMENT (continued)</th>
<th></th>
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<tbody>
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<td>Vaughan 1978</td>
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<td>Squire 1983</td>
<td>Vaughan and Recksiek 1978, 1979</td>
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<td>Squires and Barragan 1979</td>
<td>Wawrowski 1981</td>
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<tr>
<td>Suzuki et al. 1974</td>
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<th>ATLANTIC OCEAN</th>
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<td>Arnold 1979</td>
<td>Koyama 1975</td>
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<td>Balch et al. 1978</td>
<td>Kristensen 1980</td>
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<td>Clarke and Kristensen 1980</td>
<td>Matsumoto 1982</td>
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<td>Court 1980</td>
<td>Mesnil 1977</td>
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<td>Nesis 1978</td>
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<td>Okutani 1977</td>
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<td>FAO 1982</td>
<td>Pereiro and Bravo de Laguna 1980</td>
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<td>Filippova 1971</td>
<td>Rathjen and Stanley 1982</td>
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<td>Gaevskaya 1976, 1977</td>
<td>Robson 1948</td>
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<td>Gaevskaya and Nigamatullin 1976</td>
<td>Roper and Young 1975</td>
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<td>Hamabe et al. 1975</td>
<td>Sasaki 1929</td>
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<td>Hanlon et al. 1979</td>
<td>Shevtsova 1979</td>
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<td>Shevtsova et al. 1977</td>
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<td>Voss 1973</td>
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<td>Wolff and Wormuth 1979</td>
<td></td>
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<td>Kawamura 1980</td>
<td>Wormuth 1971, 1975</td>
<td></td>
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<td>Korzun et al. 1979</td>
<td>Zuev and Nesis 1971</td>
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<th>CAMERA</th>
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<td>Clarke 1966</td>
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<td>Shibata and Flores 1972</td>
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<th>COMMERCIAL FISHING</th>
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<tbody>
<tr>
<td>Arnold 1979</td>
<td></td>
<td>Klett Traulsen 1981, 1982</td>
</tr>
<tr>
<td>Balch et al. 1978</td>
<td></td>
<td>Koyama 1975</td>
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<td>Ben-Yami 1976</td>
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<td>Matsumoto 1982</td>
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<td>Okutani and Tung 1978</td>
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<tr>
<td>Court 1980</td>
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<td>Pereiro and Bravo de Laguna 1980</td>
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<td>Dewees and Price 1983</td>
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<td>Tung 1981</td>
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<td>Engel 1975</td>
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<td>Voss 1973</td>
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<td>Flores 1972, 1982</td>
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<td>Zuev and Nesis 1971</td>
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<tr>
<th>DIPNET</th>
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<tbody>
<tr>
<td>Kato and Hardwick 1975</td>
<td></td>
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</tr>
<tr>
<td>Voss 1971</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### DISTRIBUTION (REGIONAL)
- Alvariño and Hunter 1981
- Anonymous 1982b
- Arnold 1979
- Balch et al. 1978
- Belyayev 1962
- Bernard 1981
- Berry 1914
- Blackburn 1968
- Blackburn et al. 1970, 1972
- Calliet et al. 1979
- Clarke 1966, 1972, 1980
- Fields 1965
- Filippova 1971
- Gaevskaya and Nigamatullin 1976
- Hurley 1978
- Kato and Hardwick 1975
- King and Iversen 1962
- Klett Traulsen 1981, 1982
- Korzun et al. 1979
- McGowan 1967
- McInnis and Broenkow 1978
- Okutani 1974
- Okutani and McGowan 1969
- Packard 1972
- Pearcy 1965
- Sasaki 1929
- Sato 1975a, 1975b
- Squire 1983
- Suzuki 1963
- Voss 1971
- Wormuth 1971, 1975
- Yanamato and Okutani 1975
- Young 1972, 1975b
- Zuev and Nesis 1971
- Zuev et al. 1975

### DISTRIBUTION (SEASONAL)
- Anonymous 1982b
- Arnold 1979
- Ashmole and Ashmole 1968
- Blackburn 1968
- Blackburn et al. 1970
- Calliet et al. 1979
- Clarke 1966, 1980
- Fields 1965
- Kato and Hardwick 1975
- Murakami et al. 1981
- Pearcy 1965
- Whitaker 1980
- Young 1975b
- Zuev and Nesis 1971

### DISTRIBUTION (VERTICAL)
- Arnold 1979
- Clarke 1966
- Nesis 1972, 1973a, 1977a
- Packard 1972
- Pearcy 1965
- Pieper 1979
- Roper and Young 1975
- Suzuki et al. 1974
- Voss 1967, 1971
- Yanamato and Okutani 1975
- Young et al. 1980
- Zuev and Nesis 1971

### DREDGE
- Belyayev 1962

### EASTERN PACIFIC OCEAN
- Ally et al. 1978
- Alvariño and Hunter 1981
- Anonymous 1982a
- Arnold 1979
- Belyayev 1962
- Ben-Yami 1976
- Bernard 1980
- Bernard 1981
- Berry 1912
- Berzin 1971
- Calliet et al. 1979
- Christofferson et al. 1978
- Clarke 1966, 1977
- Clarke et al. 1976
- Clarke and MacLeod 1980
- Dawe 1981
- Dewees and Price 1983
- Evans 1975
- FAO 1979
- Fields 1965
- Filippova 1971
- Fiscus 1982
- Fiscus and Mercer 1982
- Greenblatt 1981, 1982
EASTERN PACIFIC OCEAN (continued)
Grieb 1978
Hochberg 1974
Hochberg and Fields 1980
Huey 1930
Iverson 1971
Jefferts and Pearcy 1979
Juanico 1980
Karpov and Calliet 1978, 1979
Kashiwada and Recksiek 1978
Kashiwada et al. 1979
Kato and Hardwick 1975
Knipe and Beeman 1978
Laevastu and Larkins 1981
Matsumoto 1982
McGowan 1954, 1967
McGowan and Okutani 1968
McHugh 1952
McInnis and Broenkow 1978
Mears et al. 1981
Mercer 1981
Morejohn et al. 1978

Nesis 1972, 1973a
Okutani 1974
Okutani and McGowan 1969
Oliphant 1971
Pearcy 1965
Pieper 1979
Pinkas 1971
Rau et al. 1983
Rice 1963
Roper and Young 1975
Sasaki 1929
Spratt 1978, 1979
Squire 1983
Stroud et al. 1981
Vaughan and Recksiek 1978, 1979
Voss 1973
Walker 1981
Wormuth 1971, 1975
Young 1972
Zuev and Nesis 1971

EASTERN TROPICAL PACIFIC OCEAN
Alverson 1963
Anonymous 1982a
Arnold 1979
Bernard 1981
Berzin 1971
Blackburn 1968
Blackburn et al. 1970
Blackburn and Laurs 1972
Blunt 1960
Clarke 1966
Clarke et al. 1976
Clarke and Trillmich 1980
FAO 1979
Fields and Gauley 1972
Filippova 1971
Hamabe et al. 1975
Harris 1973
Hoyle 1904
Juanico 1980
Juhl 1955
King and Iversen 1962
Klett Traulsen 1981
Korzun et al. 1979

Kubodera and Okutani 1981
Lee 1981
McGowan 1967
McGowan and Okutani 1968
Mears 1981
Okutani 1974, 1977
Okutani and Tung 1978
Olson 1982
Perrin et al. 1973
Rau et al. 1983
Robson 1948
Roper and Young 1975
Sato 1975a, 1975b
Squires et al. 1971
Squires and Barragan 1979
Volkov and Moroz 1977
Voss 1971
Voss 1973
Wolff 1982a, 1982b
Wormuth 1971
Wormuth 1975
Zuev and Nesis 1971
FEEDING HABITS (FISH)
Alverson 1963
Arnold 1979
Ashmole and Ashmole 1968
Ashmole and Ashmole 1967
Beddington and May 1982
Blackburn 1968
Blackburn and Laurs 1972
Blunt 1960
Clarke and Stevens 1974
Cohen et al. 1981
Coleman and Hobday 1982
Fields 1965
Gaevskaya and Nigmatulin 1976
Hess and Toll 1981
Iversen 1962
Iverson 1971
Juhl 1955
Kato and Hardwick 1975
King and Ikehara 1956

FEEDING HABITS (MARINE MAMMALS)
Arnold 1979
Beddington and May 1980, 1982
Belyayev 1962
Berzin 1971
Clarke 1966, 1972, 1977
1980, 1981
Clarke and Kristensen 1980
Clarke et al. 1980
Clarke and MacLeod 1980
1982a, 1982b
Clarke and Trillmich 1980
Evans 1975
FAO 1979
Fields 1965
Fiscus 1982
Gaevskaya and Nigmatulin 1976
Gaskin and Cawthorn 1967
Huey 1930
Kato and Hardwick 1975

FEEDING HABITS (SEABIRDS)
Anonymous 1982a
Arnold 1979
Ashmole and Ashmole 1968
Ashmole 1968
Ashmole and Ashmole 1967
Beddington and May 1982
Clarke and Trillmich 1980
Clarke and Prince 1981

King and Iversen 1962
Laevastu and Larkins 1981
McHugh 1952
Mearns et al. 1981
Morejohn et al. 1978
Nesis 1970
Okutani and Tung 1978
Oliphant 1971
Olson 1982
Packard 1972
Pearcy 1965
Perrin et al. 1973
Pinkas 1971
Rau et al. 1983
Reintjes and King 1953
Sato 1975a, 1975b
Waldron and King 1963
Wolff 1982b
Young 1975b
Zuev and Nesis 1971

Kawakami 1976, 1980
Kawamura 1971, 1980
Laevastu and Larkins 1981
Lipinski and Wrzesinski 1982
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Mearns et al. 1981
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Mercer 1981
Morejohn et al. 1978
Nesis 1970
Rau et al. 1983
Rice 1963
Sato 1975a, 1975b
Shomura and Hida 1965
Stroud et al. 1981
Volkov and Moroz 1977
Walker 1981
Wolff 1982b
Zuev and Nesis 1971

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Lipinski and Wrzesinski 1982
Mercer 1981
Morejohn et al. 1978
Okutani and Tung 1978
Schreiber and Hensley 1976
Young 1975b
Zuev and Nesis 1971
FEEDING HABITS (SQUID DIET)
Arnold 1979
Beddington and May 1980
Beddington and May 1982
Boletzky 1977
Clarke 1966, 1981
Fields 1965
Gaevskaya 1977
Gaevskaya and Nigmatullin 1976
Hochberg 1974
Japan Marine Fishery Resource Research Center 1978
Karpov and Calliet 1978, 1979
Kato and Hardwick 1975
Laevastu and Larkins 1981
Lange and Sissenwine 1980
Laughlin and Livingston 1982
Lipinski and Wrzesinski 1982
May et al. 1979
Mearns et al. 1981
Nesis 1970
Okutani and Tung 1978
Packard 1972
Rau et al. 1983
Sato 1975a, 1975b
Squires and Barragan 1979
Suzuki 1963
Tung 1976, 1981
Voss 1967
Walker 1981
Wormuth 1971, 1975
Young 1975b
Zuev and Nesis 1971

GILLNET
Bernard 1980, 1981
Court 1980
Fiscus and Mercer 1982
Iversen 1962
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GROWTH
Arnold 1979
Clarke 1966
Dawe 1981
FAO 1982
Fields 1965
Hamabe et al. 1975
Hurley and Beck 1979
Kato and Hardwick 1975
Kristensen 1980
Laevastu and Larkins 1981
Lange 1980
Lange and Sissenwine 1980
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Mesnil 1977
Murakami et al. 1981
Nesis 1970, 1977a
Okutani and Tung 1978
Packard 1972
Pereiro and Bravo de Laguna 1980
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Sissenwine and Tibbetts 1977
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McGowan and Okutani 1968
Nesis 1970, 1972, 1982
Okutani 1974, 1980
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Roeleveld 1982
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Okutani 1977  
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Lee 1981  
McGowan and Okutani 1968  
Nesis 1970  
Okutani and McGowan 1969  
Tung 1981  
Wolff 1982a, 1982b  
Wolff and Wormuth 1979  
Wormuth 1971, 1975  
Young 1972

NETS
Ally and Keck 1978  
Amaral and Carr 1980  
Arnold 1979  
Bernard 1980  
Blackburn 1968  
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Blackburn and Thorne 1974  
Clarke 1966, 1977  
Dewees and Price 1983  
Greenblatt 1981  
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Kashiwada and Recksiek 1978  
Kato and Hardwick 1975  
Okutani 1974  
Okutani and McGowan 1969  
Pearcy 1965  
Robson 1948  
Voss 1971  
Wormuth 1971, 1975  
Yanamoto and Okutani 1975  
Zuev and Nesis 1971

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Arnold 1979  
Ashmole and Ashmole 1968  
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Belyayev 1962  
Ben-Yami 1976  
Berry 1914  
Berzin 1971  
Clarke 1966, 1977, 1960  
Clarke and MacLeod 1982a  
Coleman and Hobday 1982  
Court 1980  
Filippova 1971  
Flores 1972  
Gaskin and Cawthorn 1967  
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Hess and Toll 1981  
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Iversen 1962  
Japan Marine Fishery Resource Research Center 1978  
Kawaguchi and Nazumi 1972  
Kawakami 1976, 1980  
Kawamura 1971, 1980  
King and Ikehara 1956  
King and Iversen 1962  
Korzun et al. 1979  
Kubodera and Okutani 1981  
Kubodera and Yoshida 1981  
Mercer 1981  
Murakami et al. 1981  
Nesis 1977b  
Okutani 1977  
Okutani and Tung 1978  
Reintjes and King 1953  
Roper and Young 1975
PACIFIC OCEAN (continued)
Sasaki 1929
Schreiber and Hensley 1976
Shevtsova et al. 1977, 1979
Shomura and Hida 1965
Suzuki 1963, 1975
Tung 1976, 1981
Voss 1973
Waldron and King 1963

Wolff 1982a, 1982b
Wormuth 1971, 1975
Yajima and Mitsugi 1975
Yanamoto and Okutani 1975
Young et al. 1980
Zuev and Nesis 1971

PARASITE
Clarke 1966
Fields 1965
Gaevskaya 1976, 1977
Gaevskaya and Nigamatullin 1976
Hochberg and Fields 1980

Okutani and Tung 1976
Overstreet and Hochberg 1975
Tung 1976
Zuev and Nesis 1971

PRESERVATION
Roper and Sweeney In Press

PUMPS
Arnold 1979
Ben-Yami 1976
Dewees and Price 1983

Flores 1982
Kato and Hardwick 1975
Matsumoto 1982

PURSE SEINE
Alverson 1963
Calliet et al. 1979
Dewees and Price 1983
Flores 1982
Kato and Hardwick 1975

Olson 1982
Perrin et al. 1973
Pinkas 1971
Waldron and King 1963

REPRODUCTION
Anonymous 1982a
Arnold 1979
Balch et al. 1978
Burukovski et al. 1977
Clarke 1966
FAO 1982
Fields 1965
Grieb and Beeman 1978
Hamabe et al. 1975
Kato and Hardwick 1975
Knipe and Beeman 1978
Laevastu and Larkins 1981

Lange 1980
Lange and Sissenwine 1980
Lee 1981
McGowan 1954
Mesnil 1977
Okutani and Tung 1978
Packard 1972
Sato 1975a, 1975b
Squires and Barragan 1979
Young 1975a, 1978
Zuev and Nesis 1971

STOCK DETERMINATION
Ally and Keck 1978
Christofferson et al. 1978
Clarke 1965
FAO 1982

Gaevskaya and Nigamatullin 1976
Kashiwada and Recksieck 1978
Shevtsova et al. 1977, 1979

TAGGING
Japan Marine Fishery Resource Research Center 1978
TRAWL SURVEYS AND FISHING
Alvariño and Hunter 1981
Amos and Demello 1982
Anonymous 1980, 1982a
Arnold 1979
Ashmole and Ashmole 1968
Blanchard et al. 1978
Blott 1980
Caddy 1981
Calliet et al. 1979
Clark and Brown 1979
Clarke 1966, 1977
Court 1980
Engel 1975
Flores 1972
Hamabe et al. 1975, 1982
Hurley and Waldron 1978
Jefferts and Pearcy 1979
Juanico 1982
Karpov and Calliet 1978, 1979
Kashwada and Recksiek 1978
Kato and Hardwick 1975
King and Iversen 1962
Koyama 1975
Kubodera and Okutani 1981
Lange and Sissenwine 1980
Laughlin and Livingston 1982
Matsumoto 1982
Mercer 1975
Mercer 1981
Mesnil 1977
Okutani 1974, 1977
Pearcy 1965
Pereiro and Bravo de Laguna 1980
Robson 1948
Roper 1977
Squires et al. 1971
Squires and Barragan 1979
Wawrowski 1981
Whitaker 1980
Wormuth 1971, 1975
Young et al. 1980
Zuev and Nesis 1971
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