# Micronekton in the North Pacific ... what do we know?

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# "micronekton" defined ...

- Small but actively swimming organisms ranging from ca. 2 to 10 cm; mainly mesopelagic (200-1000 m depths)
- Taxa too vagile to be caught with conventional plankton nets yet too small to be retained by most large trawls.
  - Fishes mainly mesopelagics and juveniles of epipelagic nekton
  - Crustaceans includes adult euphausiids, pelagic decapods, mysids, hyperiid amphipods
  - Cephalopods small adults and subadults of large oceanics
- Many undertake extensive diel vertical migrations

## Why do we care?

- Represents a substantial biomass in the world's oceans
- A critical but poorly understood intermediate (missing?) trophic link between the mesozooplankton & higher trophic levels (i.e., fish, marine mammals, etc.)
- Significant contributors to the "biological pump" (i.e., rapid transport of C<sub>surface</sub>, as well as pollutants, to deep sea).



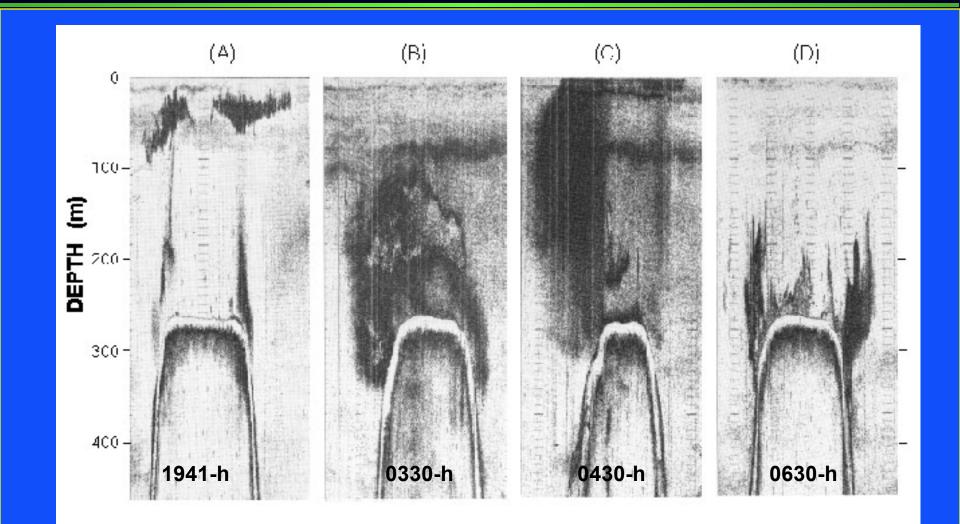
- Relatively scant attention paid to micronekton as a whole
- In 1997, PICES establishes a WG to assimilate knowledge of micronekton & their sampling in the North Pacific
- Broadly, much of what is known results from research of the 1960s & 70s
- most focused on the marginal seas around the basin rim (i.e., we know least about the open ocean)
- ... and little effort expended in comparing relative sampling efficiencies and selectivity of the gears

PICF's Scientific Report No. XX 2004 Micronekton of the North Pacific PRDS Working Group 11 **Final Report** Britted by Richard Brodeur and Orio Yuma incru-Contributors: Richerd State or Kenneth Coyle John Dower anne Gömer, Gutté reg-Nacka Igrahi Koulchi Kawaguchi David Mackas Kuzashi Miyeshite Vadire Sawinysh Michael Sala Seen Textler Urio Yamanuta Won Duk Yoon Deals \$22944 Version 18

research around Hawaii and the Central North Pacific:

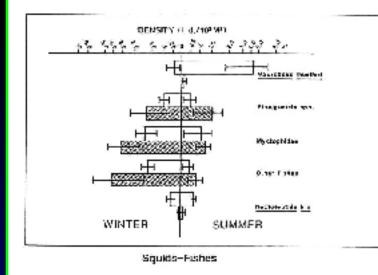
- King & Iversen (1962): oceanic Central Pacific & Hawaii 6' & 10' IKMT; z<sub>max</sub> ~ 350 m
- Clarke, Young, and others (1972-78): off Hawaii; 6' & 10' IKMT, Cobb trawl; z<sub>max</sub> to 1200 m
- Wilson, Boehlert and others (1985-88): Hancock Smts "engybenthic" micronektonic fauna; qualitative acoustics
- Reid et al. (1991): off Hawaii; Mesopelagic Boundary Community (MBC); IOS-RT 40 m<sup>2</sup>, HU-200 m<sup>2</sup> trawl; z<sub>max</sub> ~500-600 m
- Benoit-Bird and Au: off Hawaii (2001-2003): MBC, quantitative acoustics, horizontal migration, micro-patches)
- PICES (2004): off Hawaii; 6' IKMT, Cobb trawl, HU-RT gear comparison; quantitative acoustics

### SE Hancock Acoustic transects, July 1984 (38 kHz Simrad echo sounder)



# "Minimum no. species caught"

	<u>Sumn</u> 'on'	ner '84 'off'	<u>Winte</u> 'on'	<u>Winter '85</u> 'on' 'off'		
No. tows	12	6	12	10		
Crustaceans	23	26	23	29		
Fishes & cephalopods	21	24	47	61		



## **Fishes & Squid**



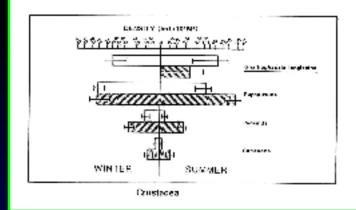
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States of the second se
Vinciguerria nimbaria



Mean densities (individuals/1000 m <sup>3</sup> water filtered)							
nekton speci	ies in the vic	inity of SE H	ancock				
arentheses indic	ate rank among f	op five species)					
Summer (J	ul-Aug '84)	Winter (Jan-Feb '85)					
"on"	"off"	"on"	"off"				
4.19 (2)	0.06	0.17	-				
0.03	0.02	0.09	0.90 (5)				
0.20	0.20	0.20	0.60				
0.80	0.03	0.39	0.73				
0.17	0.93	0.02	0.16				
0.35	0.03	0.25	-				
		0.24	0.46				
		0.10	0.20				
	Answer    Summer    Summer<	nekton species in the vic    arentheses indicate rank among f    Summer (Jul-Aug '84)    "on"  "off"    4.19 (2)  0.06    0.03  0.02    0.20  0.20    0.80  0.03    0.17  0.93	Anekton species in the vicinity of SE H      arentheses indicate rank among top five species)      Summer (Jul-Aug '84)    Winter (Ja      "on"    "on"      4.19 (2)    0.06    0.17      0.03    0.02    0.09      0.20    0.20    0.20      0.17    0.93    0.02      0.35    0.03    0.25        0.24				

### Crustaceans





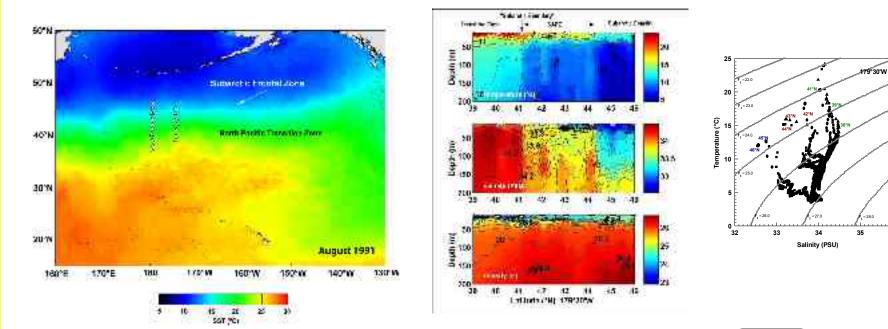
Mean densities (individuals/1000 m <sup>3</sup> water filtered)								
of selected micronekton species in the vicinity of SE Hancock								
(number in parentheses indicate rank among top five species)								
	Summer (J	ul-Aug '84)	Winter (Jan-Feb '85)					
Species	"on"	"off"	"on"	"off"				
Gnathophausia longispina	11.60 (1)	2.59 (4)	7.26 (1)	-				
Euphausia gibboides	1.23 (4)	5.50 (1)	6.98 (2)	3.27 (2)				
Euphausia hemigibba	0.82 (5)	1.93	2.65 (3)	4.28 (1)				
Euphausia mutica	1.38 (3)	2.24 (5)	0.24	0.28				
Thysanopoda monacantha	0.07	2.81 (3)	0.37	1.09 (4)				
Thysanopoda orientalis	0.15	3.75 (2)		0.06				
Thysanopoda tricuspidata		0.02	0.50	0.29				
Stylocheiron abbreviatum	0.19	0.91	0.76	1.57 (3)				
Thysanoessa gregaria			0.10	0.01				
Gennadas incertus		0.2		0.6 (5)				
Oplophorus spinosus	0.01	0.29	0.03	0.29				



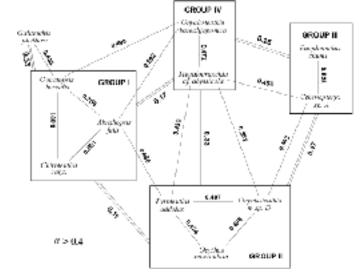




#### Cobb trawls at large-scale frontal systems, SAFZ August 1991

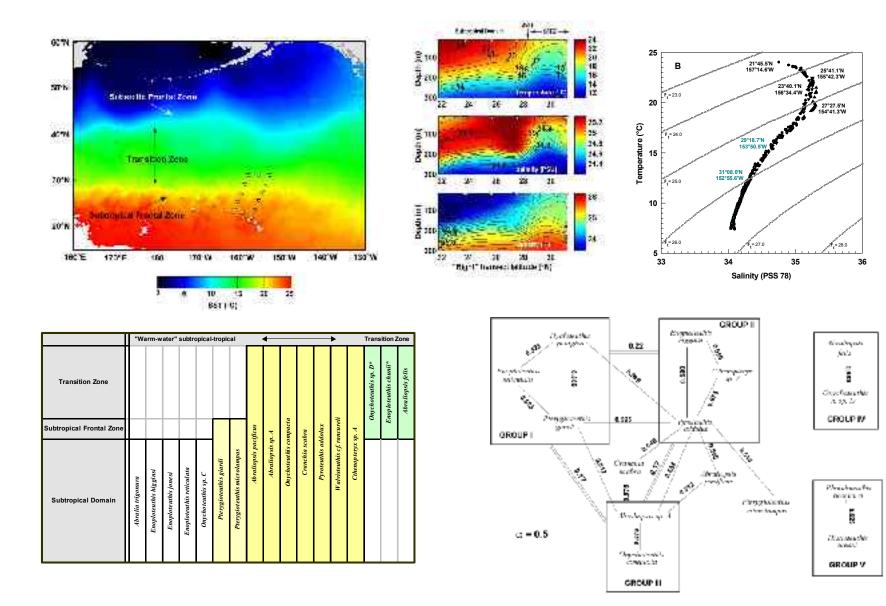


	Subtropic-Transitio	on Zone	<b>→</b> "0	Cold-water"	boreal-subarctic
Subarctic Domain		s aponica	ra lis x		Gonatus pyros Mastigoteuthis pyrodes Discoteuthis discus <sup>b</sup> Octopoteuteuthis deletron <sup>b</sup>
Subarctic Frontal Zone		a* Abraliopsis felis toteuthis boreatijap	catteutnis phytura Gonatopsis borealis Chiroteuthis calyx	Japatella diaphana	0
"Subarctic Boundary"		his his	urn teu	ella	
Transition Zone	Pyroteuthis addolux Onychoteuthis sp. D* Enoploteuthis chunii * Ocythoe tuberculata *	Megalocranchia abyssicola* Cthenopteryx sp. A Abraliopsis felis Onychoteuthis borealijaponica	oane Gona Chiro	Japat	



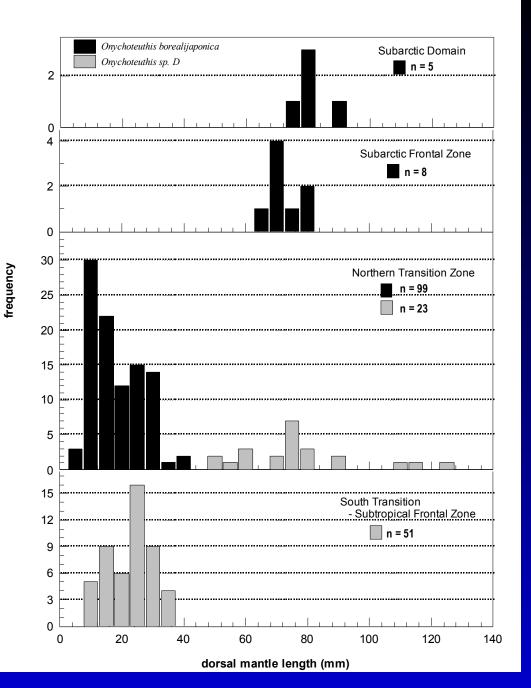
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#### **Cobb trawls at large-scale frontal systems, STFZ February 1992**



Onychoteuthis sp. D & O. borealijaponica

- South spawning north feeding migrations
- Spatially complementary distributions
- Past reports of extensive distribution likely a composite of 2 species



#### PICES Micronekton Inter-calibration Experiment (MIE) NOAA ship Oscar Elton Sette cruise 04-13 October 6-13, 2004

### **Cruise objectives:**

- to conduct the sampling for a gear comparison and to gain a subtropical perspective of the micronekton community
- use the benign weather and sea conditions to evaluate and refine the protocols, logistics, and design of the experiment



#### Micronekton Intercalibration Experiment – 1 Cruise participants

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**Richard Brodeur** National Marine Fisheries Service, NOAA NW Fisheries Science Center, Newport OR

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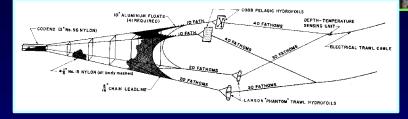
Evgeny Pakhomov Larissa Pakhomova University of British Columbia Dept. Earth & Ocean Sciences

Hiroki Yasuma Masayuki Abe Hokkaido University Graduate School of Fisheries Sciences & Faculty of Fisheries

Andrei Suntsov Harbor Branch Oceanographic Institution

# Sampling gears

### 140 m<sup>2</sup> "Stauffer modified" pelagic Cobb trawl

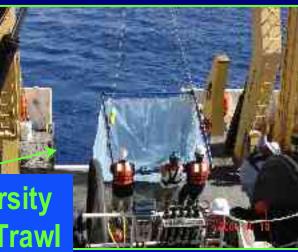




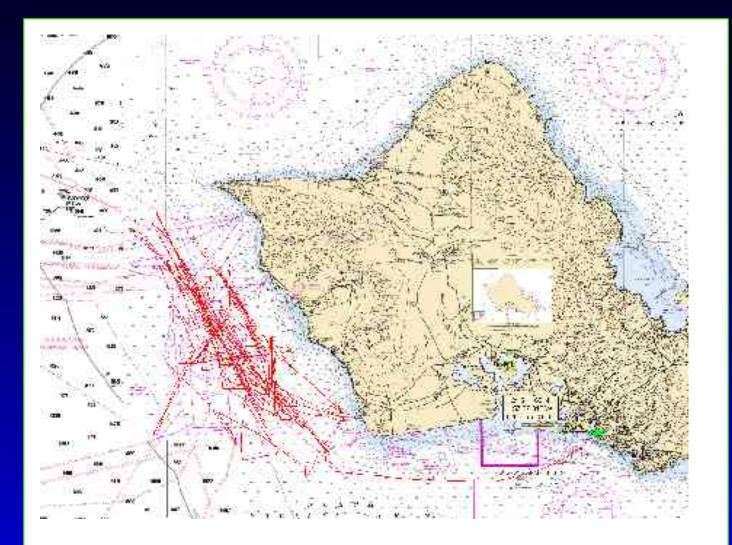


### **1.8 m IKMT**

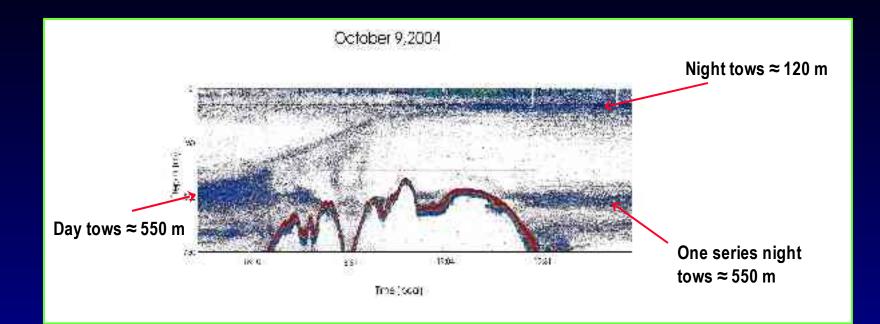
2 m Hokkaido University Rectangular Frame Trawl



# **MIE-1**, operations tracks



## EK-60 38 kHz echogram, 9 October 2004:

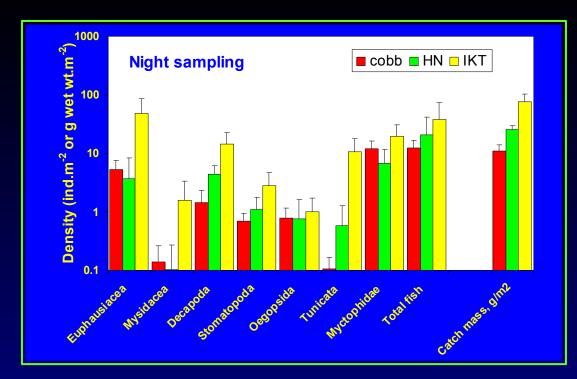


#### Simrad EK-60 38 kHz, avg Nautical Area Scattering Coefficients (m<sup>2</sup>•nmi<sup>-2</sup>)

Cobb Trawl		HU-F	R	6' IKMT	
Day	Night	Day	Night	Day	Night
472.704	288.191	428.696	318.828	390.104	321.254

## Sampling Distribution: >17 Cobb trawls >19 IKMTs >20 HU-RFTs

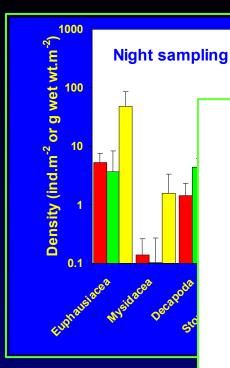
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08:00		Contraction of Res	- 150 mi			-			
06:00		Cobb Trend	JARGER -		KMT (da)		\$4mm = 230 m		
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12:50					1				
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12:00					(Zeas = 560 m)		Hokudal RFT	(Zee = 650 mg	Dent*559 m
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15:30	-			111112000	= 560 mi	SHUTT	-		
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20:00	1			120mi Cobe Trowl (c.	Jake Camp - Talling	÷			
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12:00	12			1		INNT CO.	Holander HFT		
22/30	State State State			fininde SFT (Pz.		ikiy't (2x) - (7xaa - (201a)	. \$2.mm = 659 m		
13:60		1688		Paul = 120m)	Cubb Trevil (A				
23:30		(agar = 120 11)							











**Gear-types for** intercomparison (what is micronekton?): MIE-1 – "what one defines as micronekton # another"; enabled all size range evaluation of multiple acoustic  $\lambda$ s **MIE-2** – 'appropriate' gear of similar mesh sizes; standard gear (RMT <u>1+8</u>, IKMT?); towed acoustics (high frequencies)

🗖 cobb 🧧 HN 🗖 IKT







**Opisthoproctus soleatus** 

**Oplophorus gracilirostris** 



Abralia trigonura





# What now?

 Advances in technology Signal strength (acoustics) Time series – observation systems Refined trophic links Ecosystem roles

