

**SUMMARY OF CIAC OCTOPUS WORKSHOP
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A 2-day octopus training program was held at the Phuket Marine Biology Center prior to the formal CIAC symposium. It was attended by 23 researchers, fishery resource managers and students (see Table 1). The primary focus of the workshop was to: 1) discuss the current state of generic and species level taxonomy; 2) define key morphological, meristic and molecular characters that can be utilized for identification and description of octopus taxa; 3) clarify the taxonomy of the local octopus fauna; 4) discuss biogeographic distribution (vertical and horizontal) as it relates to generic diversity of benthic octopuses in the world oceans.

At present the majority of benthic octopuses are allocated to 29 genera within the family Octopodidae. Of these, 13 genera are monotypic, 4 have two or more species and another 5 are currently unresolved. An additional 25 generic or species-group names are known to be synonyms of existing genera. At least 15 new genera are recognized and currently awaiting diagnosis.

Approximately 120 species level names are currently recognized as valid. Of these over half (about 65) are allocated to 4 genera, namely *Octopus* s.s., *Amphioctopus*, *Callistoctopus* and *Benthooctopus*. The generic placement of an

Table 1. Participants in the CIAC 2003 octopus workshop listed by countries represented.

AUSTRALIA:	Dr. Mark D. Norman• (Museum of Victoria, Melbourne) Mr. Timothy N. Stranks (Museum of Victoria, Melbourne)
DENMARK:	Ms. Kathe R. Jensen (Zoological Museum, Copenhagen) Dr. Jorgen Knudsen (Zoological Museum, Copenhagen)
FRANCE:	Dr. Renata Boucher-Rodoni• (Museum Nationale d'Histoire Naturelle, Paris)
IRELAND:	Dr. Louise Allcock• (Queen's University, Belfast)
JAPAN:	Dr. Ian Gleadall (Tohoku Bunka Gakuen University, Sendai) Dr. Kotaro Tsuchiya (University of Fisheries, Tokyo) Mr. Hideo Sakaguchi (Ehime Prefecture Chuyo Fishery Experimental Station) Dr. Tsunemi Kubodera (National Science Museum, Tokyo)
TAIWAN:	Ms. Natsumi Kaneko*• (University of the Ryukyus, Okinawa) Ms. Chuan-Wen Ho* (National Chung Hsing University, Taichung) Ms. Chia-Ling Hsu* (National Sun Yat-sen University, Taichung) Ms. Meng-Min Hsueh* (National Chung Hsing University, Taichung) Mr. Kwen-Shen Lee (National Museum of Natural Science, Taichung) Mr. Jian-Xiang Liao (National Sun Yat-sen University, Taichung)
THAILAND:	Dr. Anuwat Nateewathana• (Department of Marine and Coastal Resources, Bangkok) Ms. Vararin Vongpanich (Department of Marine and Coastal Resources, Phuket) Mr. Thanakom Bundhitwongrut (Natural History Museum, Pathumthani) Ms. Amara Cheunpan (Department of Marine and Coastal Resources, Bangkok)
USA:	Dr. F.G. (Eric) Hochberg• (Museum of Natural History, Santa Barbara) Ms. Christine L. Huffard• (University of California, Berkeley) Ms. Danielle Schulman* (University of California, Santa Barbara)

• Presenter

* Student

additional 45 species can not be determined. A further 70+ species, either described principally from tropical waters or based on single specimens or juvenile types, are insufficiently diagnosed such that their taxonomic status is unresolved. Over 150 species are recognized as new and where sufficient well fixed material is available many of these are in the process of being described. Species names are reviewed by Norman and Hochberg (this volume).

In summary there are numerous inadequately described octopus species which has resulted in a morass of synonyms. Most of the common, shallow water species, for example *Octopus vulgaris*, with wide distributions have been repeatedly named and described throughout their ranges.

In an attempt to deal with complex taxonomic issues relating to benthic octopuses a total of 19 short overviews were presented by participants during the workshop (see Table 2). Afternoons were spent in hands-on study of both live animals and preserved specimens of regional species. A number of handouts were distributed to participants during the program, including: 1) list of octopus genera; 2) vertical and horizontal distribution of genera; 3) a list of Thailand octopuses and pertinent literature; 4) parasite summary by genus; 5) morphology overview; 6) definitions of indices; 7) examples of data sheets and parasite autopsy sheets. As a result of discussions during the workshop a consensus of characters useful for generic diagnoses and species descriptions was developed. The characters are summarized in Table 3.

Table 2. Program topics for CIAC 2003 octopus workshop.

A. Current Status of Octopus Systematics	Norman
B. Character Analysis – Descriptive Formats	
· Morphological characters of diagnostic value	Norman
· Skin Patterns and Textures of Live Animals	Hochberg
· Eggs and Hatchlings	Hochberg
· Molecular Confirmation	Boucher-Rodoni
· Cryptic and Pygmy Species	Hochberg
· Habitat and Benthic Substrate	Hochberg
· Biology and Behavior	Huffard
· Parasites	Hochberg
C. Octopus of Thailand and Indo-west Pacific	
· Local Fauna	Nateewathana
· Fishery Targets	Nateewathana
D. Stabilizing Generic Level Taxonomy	Hochberg
E. Generic Diversity in Benthic Octopuses	
· Shallow-water (tropical)	Norman
· Shallow-water (temperate)	Hochberg
· Shallow-water (polar)	Allcock
· Mid-depth Transitions	Hochberg
· Deep-water	Allcock
· Sea Mounts	Norman
F. Hands-On Study (preserved specimens and live animals)	Group
G. Wrap-Up and Future Directions	Hochberg

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Table 3. Diagnostic characters for generic and species level separation. Abbreviation: ML = mantle length.

Characters (general)	Characters (specific)	Genus	Species
SUCKERS	1. normal suckers	a. 1 or 2 rows	- total number per arm - sucker shape - diameters
	2. enlarged suckers	a. present or absent; b. present on arms of both sexes or only males c. arms and location d. number per arm	- diameters
	3. modifications of sucker rims	a. present or absent b. present on arms of both sexes or only males	- configuration
	4. modified suckers at arm tips	a. present or absent; b. present on arms of both sexes or only males	- configuration
BODY			- length of mantle - total wet weight
ARMS	1. arm to body ratio	a. long, medium or short	- specific ranges
	2. arm length formula	a. configuration	- lengths of each arm pair relative to each other
	3. arm autotomy	a. present or absent	- level along arm at which autotomy occurs
	4. shape	a. wide or narrow b. elongate or blunt taper	
WEBS	1. web depth formula	a. configuration	- web depths relative to each other
	2. web margins	a. present or absent	- extent
WATER PORES		a. present or absent	
FUNNEL ORGAN	1. shape	a. W, VV, IIII, other	- lengths of outer and inner limbs relative to each other
INK SAC and ANAL FLAPS	2. size	a. length relative to length of funnel	- size of reservoir
	1. ink sac 2. anal flaps	a. present or absent a. present or absent b. shape	- length
GILL LAMELLAE	3. position of ink duct opening	a. within rectum or distal to anus	
	1. lamellae number	a. range in lamellae number b. relative number of inner versus outer lamellae	- specific number
	2. gill shape attributes	a. length relative to ML b. relative length of inner versus outer lamellae	- specific length
STYLETS		a. present or absent b. length relative to ML c. chitinous or calcareous	- specific length - shape
HECTOCOTYLIZED ARM	1. arm 3	a. right or left b. length range relative to ML c. length range relative to opposite arm	- specific length
COPULATORY ORGAN	1. ligula	a. shape b. configuration of groove c. length range relative to arm length	- specific length
	2. calamus	a. present or absent b. length range relative to ligula length c. shape	- specific length
SPERMATOPHORES	1. size	a. relative lengths of various portions	- total length
	2. numbers	a. range in numbers	- number
	3. armed with teeth	a. present or absent	
	4. shape	a. swollen portions b. ejaculatory apparatus configuration	
	5. sperm cord reservoir		- number of sperm cord whorls

Table 3. (continued)

Characters (general)	Characters (specific)	Genus	species
OVARIAN EGGS	1. development	a. from germinal disk or entire ovarian wall	
	2. size at maturity	a. relative size	- lengths and widths
	3. follicular folds		- number- cross connections
SPAWNED EGGS	1. size		- length and width - stalk length
	2. shape	a. configuration	
	3. arrangement	a. laid singly, in festoons or balls	- number of eggs per festoon (string) or ball
	4. brood location	a. attached to substrate or brooded in web	
	5. relative number		- specific number
HATCHLINGS	1. habits	a. planktonic or benthonic	
	2. arm length formula	a. configuration	- lengths of each arm pair relative to other pairs
	3. suckers	a. number per arm b. sucker sizes	
RADULA	1. tooth number	a. number per transverse row	
	2. configuration	a. number of cusps on rhachidian teeth (<i>i.e.</i> , multicuspid or acuspid)	- individual tooth shape
SKIN	1. chromatophores	a. present or absent	- primary color of live animal
	2. tubercles	a. present or absent b. distribution on body	
	3. patch and groove system	a. present or absent	- patch shape
	4. lateral ridge	a. present or absent	- lateral extent along body
	5. primary papillae	a. present or absent b. distribution on body	- sizes - shapes
	6. white spots	a. present or absent b. specific locations	- sizes - shapes
	7. dark spots (maculae)	a. present or absent b. specific location	- sizes - shapes
	8. bars and bands	a. presence or absence of fixed markings	- configuration
	9. iridescent markings	a. present or absent b. locations of fixed markings (<i>i.e.</i> , blue ringed octopuses)	- configuration (<i>i.e.</i> , rings, lines, other)
	10. ocelli (false eye spots)	a. present or absent b. dark or light spots c. iridescent ring	- configuration - size
DISTRIBUTION	1. vertical	a. depth range	- specific depths
	2. horizontal	a. geographic range	- specific distribution
HABITAT	1. substrate preference	a. broad categories (<i>i.e.</i> , mud, sand, rock, coral)	- specific habitats
	2. habitat association	a. floral or faunal associations (<i>i.e.</i> , kelp, seagrass, corals)	- specific habitats
BEHAVIOR	1. activity patterns	a. crepuscular, diurnal or nocturnal	- details
	2. feeding strategies	a. broad strategy (<i>i.e.</i> , drill sedentary prey)	- specific foraging behaviours
	3. use of lair	a. present or absent	- details
	4. burrowing in soft substrates	a. present or absent	- details
	5. mating postures	a. distance or mounting	- specific behavior

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REFERENCE

Norman, M.D. and F.G. Hochberg. The current state of octopus taxonomy. This volume.

