

Additional Notes on the Food of Some California Nudibranchs with a Summary of Known Food Habits of California Species

BY

GARY R. McDONALD¹ AND JAMES W. NYBAKKEN

Moss Landing Marine Laboratories, P. O. Box 223, Moss Landing, California 95039

A FEW PUBLICATIONS have dealt extensively with nudibranch food habits (*e. g.*, MILLER, 1961, 1962; SWENNEN, 1961; THOMPSON, 1964), but these have treated few of the species which occur in California. This paper attempts to summarize what has previously been reported concerning food habits of species that occur in California (see Table 1) and presents additional data for some species.

The new data on food items of nudibranchs were obtained in the field while collecting nudibranchs for taxonomic and ecological studies and are not, therefore, the results of a deliberate extensive food habit study. However, we believe they should still prove useful in further investigations of nudibranch food habits. We report herein not only actual observations of ingestion of prey, but also situations in which the evidence suggests strongly that the nudibranch species has consumed a given prey species.

ADDITIONAL FOOD NOTES

On 19 December 1976 at Pescadero Point, San Mateo County, California, a single specimen of *Antiopeella barbarensis* was found on a colony of the bryozoan *Bugula californica* Robertson, 1905. The nudibranch was maintained for 9 days in a culture dish with the bryozoan. During this period, the nudibranch increased from the original 3 mm in total length to 12 mm. The animal was observed to eat the lophophores of the bryozoan.

Over a period of 3 years, several specimens of *Laila cockerelli* were found on the encrusting bryozoan *Hincksiina velata* (Hincks, 1881). When found on the bryozoan, the zooecia immediately beneath the anterior end of the nudibranch were empty, while the remainder of the colony was still intact, suggesting this species consumes the bryozoan.

In the central California area, we have observed *Tritonia festiva* to be most common where the alcyonarian *Clavularia*

sp. is also most common. Since tritoniids are known to feed on alcyonarians (WICKSTEN & DEMARTINI, 1973; GOMEZ, 1973; THOMPSON, 1971), specimens of *T. festiva* and *Clavularia* *sp.* were placed together in a culture dish of sea water. Of the 4 specimens of *T. festiva* that were offered *Clavularia* *sp.*, 3 were each seen to eat one or more polyps. We have not observed them eating any other organism.

On 2 November 1975 at Carmel Point, Monterey County, California, 2 specimens of *Ancula pacifica* were found, together with their nidosomes on the entoproct *Barentsia ramosa* (Robertson, 1900). Subsequent observation in the laboratory indicated they would eat the calyx of the entoproct.

On 27 January 1976, 2 specimens of *Aldisa sanguinea* were found on the sponge *Hymendesmia brepha* (deLaubenfels, 1930). Immediately beneath the mouth of both specimens was a depression which had been rasped into the sponge.

A single specimen of *Anisodoris nobilis* was found on the sponge *Lissodendoryx firma* (Lambe, 1895) with a depression immediately beneath the mouth of the nudibranch. *Anisodoris nobilis* has also been reported to feed on numerous other species of sponges (see Table 1).

Over a span of 3 years, numerous specimens of *Cadlina modesta* have been found on the sponge *Aplysilla glacialis* (Dybowski, 1880), often accompanied by their nidosomes. Most specimens have been found with a depression rasped into the sponge immediately beneath them, and 2 specimens were seen eating the sponge. Two specimens of *C. flavomaculata* were also found on *A. glacialis* with depressions rasped into the sponge beneath them.

A single specimen of *Discodoris heathi* was found on the sponge *Adocia gellindra* (deLaubenfels, 1932) (as *Reniera* *sp.* 2 in SMITH & CARLTON, 1975). There was a large depression rasped into the sponge beneath the nudibranch.

On 26 October 1975 at Morro Bay, San Luis Obispo County, California, 3 specimens of *Hallaxa chani* were

¹ Present address: P. O. Box 535, Aromas, California 95004

Table 1

Summary of nudibranch-food associations for species occurring in California.

(P) indicates personal observation by the authors.

Nudibranch Species	Food Item
DORIDACEA	
Anadoridacea	
SUCTORIA	
CORAMBIDAE	
<i>Corambe pacifica</i>	<i>Membranipora villosa</i> (32, 33) on <i>Membranipora serrilamella</i> (38)
<i>Doridella steinbergae</i>	<i>Membranipora</i> sp. (36) <i>Membranipora serrilamella</i> (30) <i>Membranipora membranacea</i> (32) <i>Membranipora</i> spp. (39)
OKENIDAE	
Aculinae	
<i>Ancula pacifica</i>	<i>Barentsia ramosa</i> (P)
Hopkinsiinae	
<i>Hopkinsia rosacea</i>	<i>Eurystomella bilabiata</i> (57, P)
ONCHIDORIDIDAE	
<i>Acanthodoris brunnea</i>	bryozoans (73)
<i>Acanthodoris nanaimoensis</i>	compound ascidians (P)
<i>Acanthodoris pilosa</i>	<i>Flustrellidra hispida</i> (45, 63) <i>Alcyonidium hirsutum</i> , <i>Callopora dumerili</i> (40) <i>Alcyonidium gelatinosum</i> (41, 40) <i>Alcyonidium polyoum</i> (40, 63) <i>Cryptosula pallasiana</i> (11) on <i>Alcyonidium gelatinosum</i> (61, 66) on <i>Alcyonidium polyoum</i> (49, 61)
<i>Onchidoris bilamellata</i>	<i>Balanus balanoides</i> (9, 40, 42, 61) <i>Balanus crenatus</i> (2, 61) <i>Balanus porcatus</i> (40) <i>Elminius modestus</i> (61) barnacles (11, P)
<i>Onchidoris muricata</i>	<i>Alcyonidium polyoum</i> (61) <i>Celleporella hyalina</i> , <i>Cryptosula pallasiana</i> , <i>Electra pilosa</i> , <i>Escharella immersa</i> , <i>Microporella ciliata</i> , <i>Porella concinna</i> , <i>Schizomavella linearis</i> , <i>Schizoporella unicornis</i> , <i>Smittina reticulata</i> , <i>Umbonula littoralis</i> (40) <i>Membranipora membranacea</i> (3, 40, 63, 64) on <i>Reginella mucronata</i> (P)
NONSUCTORIA	
TRIOPHIDAE	
Triophinae	
<i>Triopha carpenteri</i>	<i>Caulibugula ciliata</i> , <i>Membranipora membranacea</i> , <i>Cauloramphus spiniferum</i> , <i>Scrupocellaria californica</i> , <i>Bugula mollis</i> , <i>Crisia occidentalis</i> , <i>Tricellaria</i> sp. (45) ectoprocts (93)

Table 1 (continued)

Nudibranch Species	Food Item
<i>Triopha maculata</i>	<i>Scrupocellaria californica</i> , <i>Dendrobeania laxa</i> , <i>Caulibugula ciliata</i> , <i>Bugula mollis</i> , <i>Tricellaria</i> sp. <i>Crisia occidentalis</i> , <i>Filicrisia fran-</i> <i>ciscana</i> ⁽⁴⁵⁾
POLYGERIDAE	
<i>Laila cockerelli</i>	<i>Hincksina velata</i> ^(P)
<i>Polycera atra</i>	<i>Bugula</i> ⁽³²⁾ <i>Membranipora membranacea</i> ⁽⁷⁴⁾ <i>Membranipora</i> , <i>Lophogorgia chilensis</i> ⁽³¹⁾ on <i>Bugula pacifica</i> ^(P)
<i>Polycera hedgpethi</i>	on <i>Bugula pacifica</i> ^(P)
<i>Polycera zosteræ</i>	<i>Membranipora</i> sp., ⁽³⁴⁾ on <i>Bowerbankia gracilis</i> var. <i>aggregata</i> ⁽⁸⁰⁾
Eudoridacea	
CADLINIDAE	
Cadlininae	
<i>Cadlina flavomaculata</i>	<i>Aplysilla glacialis</i> ^(P)
<i>Cadlina luteomarginata</i>	<i>Halichondria panicea</i> , <i>Myxilla incrustans</i> , <i>Higginsia</i> sp. ⁽⁷⁾
<i>Cadlina modesta</i>	<i>Aplysilla glacialis</i> ^(P)
CHROMODORIDIDAE	
<i>Chromodoris mcfarlandi</i>	on <i>Gellius</i> sp., on <i>Haliclona</i> sp. ⁽⁷⁾
<i>Chromodoris porterae</i>	on <i>Dysidea ambliæ</i> ^(P)
<i>Hypselodoris californiensis</i>	<i>Stelletta estrella</i> , <i>Haliclona</i> sp. ⁽³⁷⁾ on <i>Dysidea ambliæ</i> ^(P)
ACTINOCYCLIDAE	
<i>Hallaxa chani</i>	<i>Didemnum carnulentum</i> ^(P)
ALDISIDAE	
<i>Aldisa sanguinea</i>	on <i>Ophlitaspongia pennata</i> ⁽¹⁸⁾ <i>Hymendesmia brepha</i> ^(P)
ROSTANGIDAE	
<i>Rostanga pulchra</i>	<i>Esperiopsis originalis</i> ⁽¹³⁾ <i>Plocamia lithophoenix</i> , <i>P. karykina</i> , <i>Acarnus erithacus</i> ^(38, 71) <i>Ophlitaspongia pennata</i> ^(13, 38, 71) on <i>Isociona lithophoenix</i> , on <i>Esperiopsis originalis</i> ⁽⁷⁾
ARCHIDORIDIDAE	
<i>Archidoris montereyensis</i>	<i>Halichondria panicea</i> ^(7, 18, P)
<i>Archidoris odhneri</i>	<i>Halichondria panicea</i> ^(7, 34) <i>Myxilla incrustans</i> , <i>Mycale adhaerens</i> ⁽⁷⁾ <i>Stylissa stipitata</i> , <i>Tedania</i> sp., <i>Craniella</i> sp., <i>Syringella amphispicula</i> ⁽³⁴⁾
DISCODORIDIDAE	
<i>Discodoris heathi</i>	on <i>Halichondria panicea</i> , on <i>Myxilla incrustans</i> ⁽⁷⁾ <i>Adocia gellindra</i> ^(P)
<i>Anisodoris nobilis</i>	<i>Myxilla agennes</i> , <i>Paresperella psila</i> , <i>Zygherpe hyaloderma</i> , <i>Mycale</i> <i>macginitiei</i> , <i>Prianos</i> sp. ⁽³⁷⁾ <i>Mycale adhaerens</i> , <i>Haliclona permollis</i> , <i>Halichondria panicea</i> ⁽⁷⁾ <i>Lissodendoryx firma</i> ^(P)

Table 1 (continued)

Nudibranch Species	Food Item
<i>Diaulula sandiegensis</i>	on <i>Halichondria panicea</i> , on <i>Myxilla incrustans</i> , <i>Petrosia dura</i> ⁽⁷⁾ <i>Halichondria bowerbanki</i> ^(P) <i>Haliclona permollis</i> ^(7, 17) <i>Haliclona</i> sp. ⁽¹⁹⁾
Porodoridacea	
DENDRODORIDIDAE	
<i>Doriopsilla albopunctata</i>	<i>Cliona celata</i> , <i>Ficulina suberea</i> , <i>Acarus erithacus</i> , <i>Suberites</i> sp. ⁽⁸⁷⁾
DENDRONOTACEA	
TRITONIDAE	
<i>Tritonia diomedea</i>	<i>Virgullaria</i> sp. ⁽⁶⁴⁾ <i>Ptilosarcus gurneyi</i> ⁽⁷⁰⁾
<i>Tritonia festiva</i>	<i>Clavularia</i> sp. ^(P) <i>Ptilosarcus gurneyi</i> ^(19, 70) <i>Lophogorgia chilensis</i> ⁽¹⁹⁾
<i>Tochuina tetraquetra</i>	<i>Gersemia rubiformis</i> ⁽⁶⁸⁾ <i>Ptilosarcus gurneyi</i> ^(64, 70)
DENDRONOTIDAE	
<i>Dendronotus albus</i>	on <i>Plumularia</i> sp. ^(P)
<i>Dendronotus diversicolor</i>	on <i>Abietinaria</i> spp., on <i>Sertularella tricuspidata</i> , on <i>Hydrallmania distans</i> ⁽⁵¹⁾
<i>Dendronotus frondosus</i>	<i>Tubularia indivisa</i> ^(40, 61) <i>Tubularia larynx</i> ^(9, 40) <i>Dynamena pumila</i> , <i>Hydrallmania falcata</i> ^(24, 60) <i>Sertularia argentea</i> ⁽⁴⁰⁾ <i>Sertularia cupressina</i> ⁽⁶¹⁾ on <i>Abietinaria abietina</i> ⁽²⁴⁾ on <i>Sertularia argentea</i> ^(14, 47) <i>Coryne</i> sp. ⁽⁷³⁾ on <i>Aglaophenia</i> ⁽⁷⁵⁾ on <i>Sertularia cupressina</i> ⁽¹⁴⁾ <i>Hydractinia echinata</i> ⁽²³⁾ <i>Tubularia crocea</i> , <i>Obelia</i> spp. ⁽¹¹⁾ <i>Sertularia dichotoma</i> ⁽²²⁾ <i>Botryllus schlosseri</i> ⁽⁴³⁾
<i>Dendronotus iris</i>	<i>Pachycerianthus fimbriatus</i> ^(60, P)
<i>Dendronotus subramosus</i>	<i>Aglaophenia struthionides</i> ⁽⁵¹⁾
TETHYIDAE	
<i>Melibe leonina</i>	Gammarids, Caprellids ⁽²⁵⁾ Copepods ^(1, 25, 74) Amphipods ⁽⁷⁴⁾
DOTONIDAE	
<i>Doto amyra</i>	on <i>Obelia</i> ⁽⁷⁵⁾

Table 1 (continued)

Nudibranch Species	Food Item
ARMINACEA	
E U A R M I N O I D E A	
A R M I N I D A E	
<i>Armina californica</i>	<i>Renilla koellikeri</i> (5, 86, 65) <i>Renilla 'amethystina'</i> (39) <i>Ptilosarcus gurneyi</i> (70, P)
PACHYGNATHA	
D I R O N I D A E	
<i>Dirona albolineata</i>	<i>Margarites pupillus</i> , <i>M. helycinus</i> , <i>Lacuna carinatus</i> , ectoprocts, hydroids, small crustaceans, sponges, barnacles, tunicates (52)
<i>Dirona picta</i>	on <i>Thaumatoporella</i> sp. (P) <i>Aglaophenia</i> sp. (76) <i>Celleporella hyalina</i> (75)
Z E P H Y R I N I D A E	
<i>Antipella barbarensis</i>	<i>Bugula californica</i> (P) <i>Corymorpha palma</i> (74)
AEOLIDACEA	
E U E O L I D O I D E A	
P L E U R O P R O C T A	
C O R Y P H E L L I D A E	
<i>Coryphella trilineata</i>	on <i>Eudendrium</i> sp., on <i>Tubularia crocea</i> (P)
F L A B E L L I N I D A E	
<i>Flabellinopsis iodinea</i>	<i>Eudendrium ramosum</i> (37) <i>Diplosoma pizoni</i> (74)
ACLEIOPROCTA	
E U B R A N C H I D A E	
C u m a n o t i n a e	
<i>Cumanotus beaumonti</i>	<i>Tubularia crocea</i> (P)
E u b r a n c h i n a e	
<i>Eubranchus olivaceus</i>	on <i>Obelia longissima</i> (46)
<i>Eubranchus rustyus</i>	on <i>Hydractinia</i> sp. (38) on <i>Plumularia lagenifera</i> (34) on <i>Obelia</i> (75)
C U T H O N I D A E	
P r e c u t h o n i n a e	
<i>Precuthona divae</i>	on <i>Hydractinia</i> sp. (10, 38, P)
C u t h o n i n a e	
<i>Tenellia pallida</i>	<i>Cordylophora lacustris</i> (44) <i>Gonothyraea loveni</i> (50) <i>Protohydra leuckarti</i> , <i>Psammohydra</i> sp. (33) on <i>Obelia dichotoma</i> (12) <i>Laomedea loveni</i> , <i>L. longissima</i> , <i>Cordylophora caspia</i> (61) <i>Obelia</i> , <i>Podocoryne</i> (58)
<i>Catriona alpa</i>	<i>Tubularia marina</i> , <i>T. sp.</i> , on <i>Syncoryne eximia</i> , on <i>Obelia</i> sp. (34) on <i>Tubularia crocea</i> (P)

Table 1 (continued)

Nudibranch Species	Food Item
FIONIDAE	
<i>Fiona pinnata</i>	<i>Porpita</i> sp. ⁽³⁴⁾ <i>Lepas anatifera</i> ^(P) barnacles ⁽¹⁶⁾ <i>Lepas</i> ^(8, 38) <i>Lepas anserifera</i> ⁽⁶⁾ <i>Veleva veleva</i> ^(4, 16, 34) <i>Veleva spirans</i> ⁽²⁷⁾ <i>Veleva</i> ^(8, 37)
CLEIOPROCTA	
FACELINIDAE	
<i>Hermisenda crassicornis</i>	<i>Ptilosarcus gurneyi</i> ⁽⁷⁰⁾ <i>Obelia</i> spp., cannibalistic ⁽²³⁾
<i>Phidiana pugnax</i>	<i>Hydractinia</i> sp. ^(P)
AEOLIDIIDAE	
<i>Aeolidia papillosa</i>	<i>Tealia crassicornis</i> ^(15, 39, 67) <i>Actinia</i> , " <i>Anthea</i> " ⁽¹⁶⁾ <i>Actinia equina</i> ^(15, 40, 61, 72) <i>Anemonia sulcata</i> ^(15, 40) <i>Diadumene cincta</i> ⁽⁶¹⁾ <i>'Metridium marginatum'</i> ⁽³⁶⁾ <i>Metridium senile</i> ^(15, 61, 63, 67, 72, P) <i>Sagartia troglodytes</i> ^(40, 61) <i>Sagartiogeton undata</i> ⁽⁶¹⁾ <i>Stomphia coccinea</i> ⁽³⁵⁾ <i>Tealia felina</i> ^(15, 40, 61, 63) <i>Tubularia indivisa</i> ⁽⁴⁰⁾ <i>Tealiopsis stella</i> ⁽²³⁾ <i>Metridium dianthus</i> ⁽¹¹⁾ <i>Epiactis prolifera</i> , <i>Anthopleura xanthogrammica</i> , <i>Diadumene luciae</i> , <i>Tealia coriacea</i> , <i>Anthopleura artemisia</i> , <i>Corynactis californica</i> ⁽⁶⁷⁾ <i>Actinotheria sphyrodeta</i> , <i>Anthopleura balli</i> , <i>Sagartia elegans</i> , <i>Cereus</i> <i>pedunculatus</i> , <i>Aiptasia couchi</i> , <i>Corynactis viridis</i> ⁽¹⁵⁾ <i>Anthopleura elegantissima</i> ^(15, 39, 67)
<i>Aeolidiella takanosimensis</i>	<i>Sagartia</i> ⁽³⁸⁾
<i>Cerberilla mosslandica</i>	burrowing anemone ⁽³⁸⁾
SPURILLIDAE	
<i>Spurilla oliviae</i>	<i>Metridium senile</i> ^(23, P)
<i>Spurilla chromosoma</i>	<i>Metridium senile</i> ⁽²³⁾

In order to conserve space the full citation of the taxa discussed and listed was excluded from the table. It is given in alphabetical order below.

Mollusca

Acanthodoris nanaimoensis O'Donoghue, 1921; *A. pilosa* (Abildgaard, 1789); *Aeolidia papillosa* (Linnaeus, 1761); *Aeolidiella*

takanosimensis Baba, 1930; *Aldisa sanguinea* (Cooper, 1862); *Anacula pacifica* MacFarland, 1905; *Anisodoris nobilis* (MacFarland, 1905); *Antipella barbarensis* (Cooper, 1863); *Archidoris montereyensis* (Cooper, 1862); *A. odhneri* (MacFarland, 1966); *Armina californica* (Cooper, 1862); *Cadlina flavomaculata* MacFarland, 1905; *C. luteomarginata* MacFarland, 1966; *C. modesta* MacFarland, 1966; *Catryna alpha* (Baba

& Hamatani, 1963); *Cerberilla mosslandica* McDonald & Nybakken, 1975; *Chromodoris mcfarlandi* Cockerell, 1902; *C. porterae* Cockerell, 1902; *Corambe pacifica* MacFarland & O'Donoghue, 1929; *Coryphella trilineata* O'Donoghue, 1921; *Cumanotus beaumonti* (Eliot, 1906)
Dendronotus albus MacFarland, 1966; *D. diversicolor* Robilliard, 1970; *D. frondosus* (Ascanius, 1774); *D. iris* (Cooper, 1863); *D. subramosus* MacFarland, 1966; *Diaulula sandiegensis* (Cooper, 1862); *Dirona albolineata* Cockerell & Eliot, 1905; *D. picta* Cockerell & Eliot, 1905; *Discodoris heathi* MacFarland, 1905; *Doridella steinbergae* (Lance, 1962); *Doriopsisilla albopunctata* (Cooper, 1863)
Eubbranchus olivaceus (O'Donoghue, 1922); *E. rustys* (Marcus 1961)
Fiona pinnata (Eschscholtz, 1831); *Flabellinopsis iodinea* (Cooper, 1862)
Hallaxa chani Gosliner & Williams, 1975; *Hermisenda crassicornis* (Eschscholtz, 1831); *Hopkinsia rosacea* MacFarland, 1905; *Hypsodoris californiensis* (Bergh, 1879)
Lacuna carinata Gould, 1848; *Laila cockerelli* MacFarland, 1905
Margarites helacinus (Phipps, 1774); *M. pupillus* (Gould, 1849); *Melibe leonina* (Gould, 1852)
Onchidoris bilamellata (Linnaeus, 1767); *O. muricata* (O. F. Müller, 1776)
Phidiana pugnax Lance, 1962; *Polycera atra* MacFarland, 1905;

P. hedgpethi Marcus, 1964; *P. zosteræ* O'Donoghue, 1924; *Precuthona divae* Marcus, 1961
Rostanga pulchra MacFarland, 1905
Spurilla chromosoma Cockerell & Eliot, 1905; *S. oliviae* (MacFarland, 1966)
Tenellia pallida (Alder & Hancock, 1854); *Tochuina tetraquetra* (Pallas, 1788); *Triopha carpenteri* (Stearns, 1873); *Triopha maculata* MacFarland, 1905; *Tritonia diomedea* Bergh, 1894; *Tritonia festiva* (Stearns, 1873)

Non-Mollusca

Adocia gelindra (de Laubenfels, 1932); *Aplysilla glacialis* (Dybowski, 1880)
Barentsia ramosa (Robertson, 1900); *Bugula californica* Robertson, 1905; *B. pacifica* Robertson, 1905
Didemnum carnulentum Ritter & Forsyth, 1917
Eurystomella bilabiata (Hincks, 1884)
Halichondria bowerbanki (Burton, 1930); *H. paniceum* (Pallas, 1766); *Hincksina velata* (Hincks, 1881); *Hymendesmia brepha* (de Laubenfels, 1930)
Lepas anatifera Linnaeus, 1758; *Lissodendoryx firma* (Lambe, 1895)
Metridium senile (Linnaeus, 1767)
Pachycerianthus fimbriatus (McMurrich, 1910); *Ptilosarcus gurneyi* (Gray, 1860)
Tubularia crocea (Agassiz, 1862)

found on the ascidian *Didemnum carnulentum* Ritter & Forsyth, 1917. The nudibranchs had grazed large portions of the ascidian.

Several very large (over 100mm) specimens of both *Diaulula sandiegensis* and *Archidoris montereyensis*, along with their nidosomes, have been collected on a sponge (tentatively identified as *Halichondria bowerbanki* Burton, 1930) in an erosion channel in the upper third of Elkhorn Slough, Monterey County, California. As in many of the above cases, depressions had been rasped into the sponge. Further, this was the only species of sponge noted to be present in the channel and hence, possibly the only available food.

Over a period of 3 years, large numbers of *Cumanotus beaumonti*, frequently with their nidosomes, have been observed on and collected from the gymnoblastoid hydroid *Tubularia crocea* (Agassiz, 1862). We have never found *C. beaumonti* on any substrate other than *T. crocea*, and if the nudibranch is removed from the hydroid, it immediately seeks to return to the hydroid. In the laboratory, the eolids were observed to feed upon the polyps of the hydroid.

On 12 April 1977, large numbers of the eolid *Phidiana pugnax* were found in close association with the gymnoblastoid hydroid *Hydractinia* sp. at Carmel Point, Monterey County, California. Later, in laboratory aquaria, the *Hydractinia* colonies were quickly consumed by *P. pugnax*. We have never observed them consuming other hyd-

roids, though they are known to attack other nudibranchs under crowded aquarium conditions (LANCE, 1962a).

Over a period of several years, small (3 to 7 mm total length) specimens of *Onchidoris muricata* have been collected, almost always on the encrusting bryozoan *Reginella mucronata* (Canu & Bassler, 1923).

PREVIOUS FOOD RECORDS

Table 1 summarizes our search of the literature relevant to the recorded food habits of California nudibranchs. Included are the new data reported in this paper as well as additional personal observations of nudibranchs on possible food species which they were not actually seen to ingest (indicated by ^P). Where more than a single food item is listed, the order of listing does not imply preference (which is often unknown) of the nudibranch. We include the table as a guide to those who may find it useful in doing additional ecological or experimental studies of California nudibranchs.

DISCUSSION

The summary table includes certain nudibranch species from California that are also found in other geographical

areas (e.g., *Aeolidia papillosa*, *Acanthodoris pilosa*, *Onchidoris muricata*, *Dendronotus frondosus*, and others). Hence, the food items reported here may not necessarily be present in California. Widely distributed nudibranch species may well have additional food items or different preferences in different geographical locations. Certainly for *A. papillosa*, the studies of WATERS (1973) suggest that the major prey preferences differ between those occurring in Atlantic waters and those occurring in Pacific waters. Such differing prey preferences have not, to our knowledge, been investigated for other nudibranchs with wide geographical ranges. The whole field of prey preference studies for most California nudibranchs remains relatively little explored, and we hope this review may stimulate additional work.

ACKNOWLEDGMENTS

We wish to thank Mr. R. Shane Anderson for providing data, Dr. Penny Morris for identifying some of the bryozoans, Mr. Jeff Goddard for bringing to our attention additional references, Mr. John Cooper for providing data and additional references, Mrs. Doris Baron of Moss Landing Marine Laboratories library for the excellent help with literature, and the senior author's wife, Andrea McDonald, for help in collecting specimens and data in the field.

Literature Cited

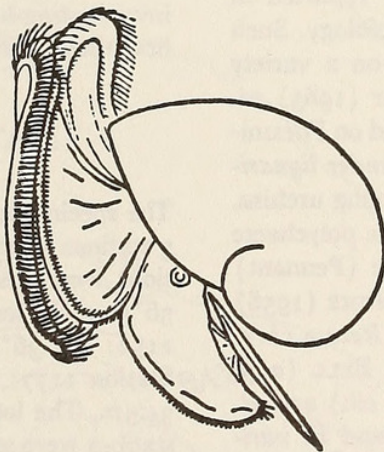
- 1 AJESKA, RICHARD A. & JAMES WILLARD NYBAKKEN
1976. Contributions to the biology of *Melibe leonina* (Gould, 1852) (Mollusca: Opisthobranchia). *The Veliger* 19 (1): 19-26; 2 pls.; 5 text figs. (1 July 1976)
- 2 BARNES, HAROLD & H. T. POWELL
1954. *Onchidoris fusca* (Müller), a predator of barnacles. *Journ. Anim. Ecol.* 23 (2): 361-363; plt. 2
- 3 BEHRENTZ, ALYSON
1931. Trekk av *Lamellidoris muricata*'s biologi og av dens generalis-jomsorganers bygning. *Nyt. Mag. Naturv. Oslo* 70: 1-26; 19 text figs.
- 4 BERGH, LUDWIG SOPHUS RUDOLPH
1880. On the nudibranchiate gastropod Mollusca of the North Pacific Ocean, with special reference to those of Alaska. Part II. *Proc. Acad. Nat. Sci. Philadelphia* 32: 40-127; pls. 9-16 (March-June)
- 5 BERTSCH, HANS
1968. Effect of feeding by *Armina californica* on the bioluminescence of *Renilla koellikeri*. *The Veliger* 10 (4): 440-441 (1 April 1968)
- 6 BIERI, R.
1966. Feeding preferences and rates of the snail, *Ianthina prolongata*, the barnacle, *Lepas anserifera*, the nudibranchs, *Glaucus atlanticus* and *Piona pinnata*, and the food web in the marine neuston. *Publ. Seto Mar. Biol. Lab.* 14: 161-170; pls. 3, 4; 1 text fig.
- 7 BLOOM, STEPHEN A.
1976. Morphological correlation between dorid nudibranch predators and sponge prey. *The Veliger* 18 (3): 289-301; 1 text fig.; 5 tables (1 January 1976)
- 8 BURN, ROBERT F.
1966. Descriptions of Australian Eolidacea (Mollusca: Opisthobranchia). 4. The genera *Pleurolidia*, *Piona*, *Learchis*, and *Cerberilla* from Lord Howe Island. *Journ. malacol. Soc. Australia* 1 (10): 21-34 16 text figs.
- 9 CAREFOOT, THOMAS H.
1967. Growth and nutrition of three species of opisthobranch molluscs. *Journ. Comp. Biochem. Physiol.* 21 (3): 627-652
- 10 CHRISTENSEN, HANS
1977. Feeding and reproduction in *Precuthona peachi* (Mollusca: Nudibranchia). *Ophelia* 16 (1): 131-142; 9 text figs.
- 11 CLARK, KERRY B.
1975. Nudibranch life cycles in the Northwest Atlantic and their relationship to the ecology of fouling communities. *Helgol. wiss. Meeresunters.* 27: 28-69; 14 text figs.
- 12 COLOAN, NATHANIEL
1913. Some additions to the nudibranch fauna of Co. Dublin. *Irish Nat.* 22: 165-168
- 13 COOK, EMILY F.
1962. A study of food choices of two opisthobranchs, *Rostanga pulchra* MacFarland and *Archidoris montereyensis* (Cooper). *The Veliger* 4 (4) 194-196; 4 text figs. (1 April 1962)
- 14 CUÉNOT, LUCIEN
1927. Contributions à la faune du Bassin d'Arcachon. IX. Revue générale de la faune et bibliographie. *Bull. Stat. Biol. d'Arcachon* 24: 229-305; 5 text figs.
- 15 EDMUNDS, MALCOLM, G. W. POTTS, R. C. SWINFEN & VIRGINIA L. WATERS
1974. The feeding preferences of *Aeolidia papillosa* (L.) (Mollusca: Nudibranchia). *Journ. Mar. Biol. Assoc. U. K.* 54: 939-947
- 16 ELIOT, CHARLES NORTON EDGEcombe
1910. A monograph of the British nudibranchiate Mollusca. *Suppl. Ray Soc. London*, part VIII: 198 pp.; 8 pls.
- 17 ELVIN, DAVID W.
1976. Feeding of a dorid nudibranch, *Diadula sandiegensis*, on the sponge *Haliclona permollis*. *The Veliger* 19 (2): 194-198; 1 text fig. (1 October 1976)
- 18 FOURNIER, ANNE
1969. Anatomie, histologie, et histochimie du tube digestif de *Pelto-doris atomaculata* Bergh. *Vie et Milieu* 20: 73-93; photos 1-6
- 19 GOMEZ, EDUARDO D.
1973. Observations on feeding and prey specificity of *Tritonia festiva* (Stearns) with comments on other tritoniids (Mollusca: Opisthobranchia). *The Veliger* 16 (2): 163-165; 1 plt. (1 Oct. 1973)
- 20 GOSLINER, TERRENCE & GARY C. WILLIAMS
1973. The occurrence of *Polycera zosteras* O'Donoghue, 1924 in the Bodega Bay region, California, with notes in its natural history (Gastropoda: Nudibranchia). *The Veliger* 15 (3): 252-253; 2 text figs. (1 January 1973)
- 21 GRAHAM, ALASTAIR
1955. Molluscan diets. *Proc. Malacol. Soc. London* 31 (3-4): 144-159
- 22 GRANT, ROBERT EDMOND
1826. On the sounds produced under water by *Tritonia arborescens*. *Edinb. Philos. Journ.* 14: 165, 185-186
- 23 HARRIS, LARRY G.
1973. Nudibranch associations. In *Current Topics in Comparative Pathobiology*, ed. T. C. Cheng. Academic Press, Inc., New York. 2: 213-315; 6 figs.
- 24 HERDMAN, WILLIAM ABBOTT
1886. On the structure and functions of the cerata or dorsal papillae in some nudibranchiate Mollusca. *Quart. Journ. Microsc. Sci.* 31: 41-63; pls. 6-10
- 25 HURST, ANNE
1968. The feeding mechanism and behavior of the opisthobranch *Melibe leonina*. *Symp. Zool. Soc. London* 22: 151-166; 8 text figs.
- 26 KASTENDIEK, JON
1976. Behavior of the sea pansy *Renilla koellikeri* Pfeffer (Coelenterata: Pennatulacea) and its influence on the distribution and biological interactions of the species. *Biol. Bull.* 151 (3): 518-537; 9 figs.
- 27 KROPP, BENJAMIN
1931. The pigment of *Velutella spirans* and *Piona marina*. *Biol. Bull. Woods Hole* 60: 120-123
- 28 LANCE, JAMES ROBERT
1961. A distributional list of southern California opisthobranchs. *The Veliger* 4 (2): 64-69 (1 October 1961)
- 29
1962a. Two new opisthobranch mollusks from southern California. *The Veliger* 4 (3): 155-159; plt. 38; 8 text figs. (1 January 1962)
- 30
1962b. A new *Stiliger* and a new *Corambella* (Mollusca: Opisthobranchia) from the northwestern [sic] Pacific. *The Veliger* 5 (1): 33-38; plt. 6; 10 text figs. (1 July 1962)

- 31 LEWBEL, GEORGE S. & JAMES ROBERT LANCE
1975. Detached epidermal sheaths of *Lophogorgia chilensis* as a food for *Polycera atra*. The Veliger 17 (4): 346 (1 April 1975)
- 32 MACFARLAND, FRANK MACE
1966. Studies of opisthobranchiate mollusks of the Pacific coast of North America. Mem. Calif. Acad. Sci. 6: xvi+546 pp.; 72 pls. (8 April 1966)
- 33 MACFARLAND, FRANK MACE & CHARLES HENRY O'DONOGHUE
1929. A new species of *Corambe* from the Pacific coast of North America. Proc. Calif. Acad. Sci. (4) 18 (1): 1-27; pls. 1-3
- 34 MARCUS, ERNST
1961. Opisthobranch mollusks from California. The Veliger 3 (Supplmt. 1): 1-85; pls. 1-10 (1 February 1961)
- 35 MARCUS, EVELINE DU BOIS-REYMOND & ERNST MARCUS
1955. Über Sand Opisthobranchia. Kieler Meeresforsch. 11 (2): 230-243; pls. 36-38
- 36 MCBETH, JAMES WARREN
1968. Feeding behavior of *Corambella steinbergae*. The Veliger 11 (2): 145-146 (1 October 1968)
- 37
1971. Studies on the food of nudibranchs. The Veliger 14 (2): 158-161 (1 October 1971)
- 38 McDONALD, GARY R. & JAMES WILLARD NYBAKKEN
1975. *Cerberilla mosslandica*, a new eolid nudibranch from Monterey Bay, California (Mollusca: Opisthobranchia). The Veliger 17 (4): 378-382; 2 text figs. (1 April 1975)
- 39 McMILLAN, NORA FISHER
1942. Food of nudibranchs. Journ. Conchol. 21: 327
- 40 MILLER, MICHAEL CHARLES
1961. Distribution and food of the nudibranchiate Mollusca of the South of the Isle of Man. Journ. Anim. Ecol. 30 (1): 95-116
- 41
1962. Annual cycles of some Manx nudibranchs, with a discussion of the problem of migration. Journ. Anim. Ecol. 31 (3): 545-569; 12 text figs.
- 42 MORSE, M. PATRICIA
1968. Functional morphology of the digestive system of the nudibranch mollusc *Acanthodoris pilosa*. Biol. Bull. 134 (2): 305-319; 9 text figs.
- 43
1969. On the feeding of the nudibranch *Coryphella verrucosa rufibranchialis*, with a discussion of its taxonomy. The Nautilus 83 (2): 37-40
- 44 NAVILE, ANDRÉ
1926. Notes sur les éolidiens. Un éolidien d'eau saumâtre. Origine des nématocystes. Zooxanthelles et homochromie. Rev. Suisse Zool. 33: 251-286; 9 text figs.
- 45 NYBAKKEN, JAMES WILLARD & JAMES EASTMAN
1977. Food preference, food availability and resource partitioning in *Triopha maculata* and *Triopha carpenteri* (Opisthobranchia: Nudibranchia). The Veliger 19 (3): 279-289; 4 text figs.; 6 tables (1 January 1977)
- 46 O'DONOGHUE, CHARLES HENRY
1922. Notes on the nudibranchiate Mollusca from the Vancouver Island region. 1. Colour variations. Trans. Roy. Canad. Inst. 14 (1): 123-130; plt. 2
- 47 PELSENEER, PAUL
1911. Recherches sur l'embryologie des gastropodes. Mém. Acad. Roy. Belg. (2) 6: 1-167
- 48 POTTS, G. W.
1970. The ecology of *Onchidoris fusca* (Nudibranchia). Journ. Marine Biol. Assoc. U. K. 50 (2): 269-292; 2 pls.; 8 text figs.
- 49 PURCHON, R. DENISON
1947. Studies on the biology of the Bristol Channel. XVII. The littoral and sublittoral fauna of the northern shores near Cardiff. Proc. Bristol Nat. Soc. 27 (3): 285-310
- 50 RASMUSSEN, ERIK
1944. Faunistic and biological notes on marine invertebrates. I. The eggs and larvae of *Brachystomia rissoides* (Hantl.), *Eulimella nitidissima* (Mont.), *Retusa truncatula* (Brug.) and *Embletonia pallida* (Alder and Hancock), (Gastropoda marina). Vidensk. Meddel. Dansk. Naturh. Foren. 107: 207-233; 20 text figs.
- 51 ROBILIARD, GORDON ALLAN
1970. The systematics and some aspects of the ecology of the genus *Dendronotus* (Gastropoda: Nudibranchia). The Veliger 12 (4): 433-479; pls. 63, 64; 28 text figs. (1 April 1970)
- 52
1971a. Predation by the nudibranch *Dirona albolineata* on three species of prosobranchs. Pacif. Sci. 25 (3): 429-435
- 53
1971b. A new species of *Polycera* (Opisthobranchia: Mollusca) from the northeastern Pacific with notes on other species. Syesis 4: 235-243; 10 text figs.
- 54
1971c. Range extensions of some northeast Pacific nudibranchs (Mollusca: Gastropoda: Opisthobranchia) to Washington and British Columbia, with notes on their biology. The Veliger 14 (2): 162-165 (1 October 1971)
- 55 ROBSON, ELAINE A.
1961. The swimming response and its pacemaker system in the anemone *Stomphia coccinea*. Journ. exp. Biol. 38 (3): 685-694
- 56 RUSSELL, HENRY DRUMMOND
1942. Observations on the feeding of *Aeolidia papillosa* L., with notes on the hatching of the veligers of *Cuthona amoena* A. & H. The Nautilus 55 (3): 80-82
- 57 SAVILOV, A. I.
1956. Floating biocoenosis in the Pacific Ocean based on the material of the expedition of the Institute of Oceanology of the Academy of Sciences, USSR. Priroda 3: 62-68 (in Russian)
- 58 SCHMEKEL, RENATE LUISE
1968. Ascoglossa, Notaspidea und Nudibranchia im Litoral des Golfes von Neapel. Rev. Suisse Zool. 75 (6): 103-155; 21 text figs.
- 59 SEED, R.
1976. Observations on the ecology of *Membranipora* (Bryozoa) and a major predator, *Doridella steinbergae*, along with fronds of *Laminaria saccharina* at Friday Harbor, Washington. Journ. Exper. Mar. Biol. Ecol. 24 (1): 1-18
- 60 SMITH, RALPH INGRAM & JAMES T. CARLTON
1975. Light's Manual: Intertidal Invertebrates of the Central California Coast. 3rd edit. Univ. Calif. Press, Berkeley. xviii+716 pp.; 156 pls.
- 61 SWENNEN, CHARLES
1961. Data on distribution, reproduction and ecology of the nudibranchiate Mollusca occurring in the Netherlands. Nederl. Journ. Sea Res. 1 (1-2): 191-240
- 62 THOMPSON, THOMAS EVERETT
1961. Observations of the life history of the nudibranch *Onchidoris muricata* (Müller). Proc. Malacol. Soc. London 34 (5): 239-242
- 63
1964. Grazing and the life cycles of British nudibranchs. In: D. J. CRISP (ed.) Grazing in terrestrial and marine environments, pp. 275-297. Blackwell, Oxford, England
- 64
1971. Tritoniidae from the North American Pacific coast (Mollusca: Opisthobranchia). The Veliger 13 (4): 333-338; 3 text figs. (1 April 1971)
- 65 TURNER, CHARLES H., EARL E. EBERT & ROBERT R. GIVEN
1969. Man-made reef ecology. Calif. Fish & Game, Fish Bul. 146: 1-221; 74 text figs.
- 66 WALTON, C. L.
1908. Nudibranchia collected in the North Sea by the S.S. Huxley during July and August, 1907. Journ. Mar. Biol. Assoc. U. K. 8: 227-240
- 67 WATERS, VIRGINIA L.
1973. Food preference of the nudibranch *Aeolidia papillosa*, and the effect of the defenses of the prey on predation. The Veliger 51 (3): 174-192; 5 text figs. (1 January 1973)
- 68 WICKSTEN, MARY K. & JOHN D. DEMARTINI
1973. Observations of the feeding habits of *Tochuina tetraquetra* (Pallas) (Gastropoda: Tritoniidae). The Veliger 15 (3): 195 (1 January 1973)
- 69 WOBBER, DON R.
1970. A report on the feeding of *Dendronotus iris* on the anthozoan *Cerianthus* sp. from Monterey Bay, California. The Veliger 12 (4): 383-387; pls. 55-57 (1 April 1970)

The following references came to our notice after the completed manuscript had been submitted and typesetting was completed. We are adding them in proof. The references have been integrated in the table and the citations are added with the numbers consecutive to the last number of the originally cited ones.

- 70 BIRKELAND, CHARLES
1974. Interactions between a sea pen and seven of its predators. Ecol. Monogr. 44 (2): 211-232; 10 text figs.
- 71 DELAUBENFELS, MAX WALTER
1927. The red sponges of Monterey Peninsula, California. Ann. Mag. Nat. Hist. (9) 19: 258-266

- 72 KALKER, H. & RENATE LUISE SCHMEKEL
1976. Bau und Funktion des Cnidosacks der Aeolidioidea (Gastropoda Nudibranchia). *Zoomorphol.* 86 (1): 41-60; 7 text figs.
- 73 KOZLOFF, EUGENE N.
1973. Seashore life of Puget Sound, the Strait of Georgia and the San Juan Archipelago. Univ. Washington Press, Seattle. pp. i-ix + 1-283; pls. 1-28
- 74 MACGINITIE, GEORGE EBER & NETTIE MACGINITIE
1949. Natural history of marine animals. McGraw-Hill Book Co., New York. pp. i-xii + 1-473; illust.
- 75 SALVINI-PLAWEN, LUITFRIED VON
1972. Cnidaria as food-sources for marine invertebrates. *Cah. Biol. Mar.* 13 (3): 385-400; 1 plt.





Mcdonald, Gr and Nybakken, James Willard. 1978. "ADDITIONAL NOTES ON FOOD OF SOME CALIFORNIA NUDIBRANCHS WITH A SUMMARY OF KNOWN FOOD-HABITS OF CALIFORNIA SPECIES." *The veliger* 21, 110-119.

View This Item Online: <https://www.biodiversitylibrary.org/item/134933>

Permalink: <https://www.biodiversitylibrary.org/partpdf/97619>

Holding Institution

Smithsonian Libraries and Archives

Sponsored by

Biodiversity Heritage Library

Copyright & Reuse

Copyright Status: In Copyright. Digitized with the permission of the rights holder.

Rights Holder: California Malacozoological Society

License: <http://creativecommons.org/licenses/by-nc-sa/3.0/>

Rights: <https://www.biodiversitylibrary.org/permissions/>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.