

Appendix Table 16.1. Distribution of California and Other Marine Fishes by Reproductive Mode, Gender Allocation and Parental Care Type

This table shows the distribution of reproductive modes (oviparous = ovip, viviparous = vivip), gender allocation (gonochore; or protogynous, protandrous, bidirectional, or simultaneous hermaphrodite), and post-oviposition parental care types (paternal, maternal or biparental) among orders, families, subfamilies or tribes (where variable within family), and species (where variable within subfamilies or tribes) of Californian and major, non-indigenous taxa of marine fishes. Representative species are noted in **bold** type if members of the California fauna. Tropical and other non-California examples are provided in support of tables 19-2 to 19-5. Gonochore-2 refers to secondary gonochore. External body brooding with parent-embryo nourishment indicated by superscripted asterisk (*).

<i>Taxon (Order, Family or Subfamily)</i>	<i>Mode</i>	<i>Gender Allocation</i>	<i>Parental Care</i>	<i>Representative Species</i>	<i>Key Reference(s)</i>
Myxiniiformes	ovip	gonochore	none		
Myxinidae				<i>Eptatretus stouti</i>	Cox 1963, Patzner 1998
Petromyzontiformes	ovip	gonochore	none		
Petromyzontidae				<i>Lampetra tridentate</i>	Michael 1984, Russell et al. 1987
Chimaeriformes	ovip	gonochore	none		
Chimaeridae				<i>Hydrolagus colliciei</i>	Cox 1963
Heterodontiformes	ovip	gonochore	none		
Heterodontidae				<i>Heterodontus francisci</i>	Dempster and Herald 1961
Orectolobiformes		gonochore	none		
Rhincodontidae	vivip			<i>Rhincodon typus</i>	Joung et al. 1996, Colman 1997
Carcharhiniiformes		gonochore	none		
Scyliorhynidae	ovip			<i>Parmaturus xaniurus</i>	Cross 1988, Balart et al. 2000
Triakidae	vivip				
Carcharhinidae	vivip			<i>Triakis semifasciata</i> <i>Prionace glauca</i>	Kusher et al. 1992 Nakano 1994
Lamniiformes	vivip	gonochore	none		
Alopiidae				<i>Alopias superciliosus</i>	Chen et al. 1997
Cetorhinidae				<i>Cetorhinus maximus</i>	Matthews 1950
Lamnidae				<i>Isurus oxyrinchus</i>	Mollet et al. 2000
Hexanchiformes					
Chlamydoselachidae	vivip	gonochore	none	<i>Chlamydoselachus anguineus</i>	Tanaka et al. 1990
Squaliformes					
Squalidae	vivip	gonochore	none	<i>Squalus acanthias</i>	Jones and Geen 1977
Squatiniiformes					
Squatinae	vivip	gonochore	none	<i>Squatina californica</i>	Natanson and Cailliet 1986
Rajiformes		gonochore	none		
Torpedinidae	vivip			<i>Tetronarce californica</i>	Neer and Cailliet 2001
Rhinobatidae	ovip			<i>Pseudobatos productus</i>	Villavicencio-Garayzar 1993
Rajidae	vivip			<i>Beringraja binoculata</i>	Timmons and Bray 1997
Urotrygonidae	vivip			<i>Urobatis halleri</i>	Villavicencio et al. 1994
Gymnuridae	vivip			<i>Gymnura marmorata</i>	Babel 1967
Myliobatidae	vivip			<i>Myliobatis californica</i>	Villavicencio-Garayzar 1995
Mobulidae	vivip			<i>Mobula birostris</i>	Martin and Cailliet 1988, Yano et al. 1999
Acipenseriformes					
Acipenseridae	ovip	gonochore	none	<i>Acipenser transmontanes</i>	Chapman et al. 1996

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Clupeiformes					
Clupeidae	ovip	gonochore	none	<i>Opisthonema libertate</i>	Torres-Villegas and Perez-Gomez 1988
Engraulidae				<i>Anchoa spp.</i>	Caddell 1988
Osmeriformes	ovip	gonochore	none		
Argentinidae				<i>Argentina sialis</i>	Bergstad 1993
Osmeridae				<i>Hypomesus pretiosus</i>	Middaugh et al. 1987
Salmoniformes	ovip				
Salmonidae		gonochore	maternal	<i>Oncorhynchus nerka</i>	McPhee and Quinn 1998
Stomiiformes	ovip		none		
Gonostomatidae		protandry		<i>Cyclothone spp.</i>	Miya and Nemoto 1991
Sternoptychidae		?		<i>Sternoptyx diaphana</i>	Baird et al. 1990
Aulopiformes	ovip		none		
Alepisauridae		simultaneous		<i>Alepisaurus ferrox</i>	Mead 1960, Smith and Atz 1973
Myctophiformes	ovip		none		
Myctophidae		gonochore		<i>Stenobrachius leucopsaurus</i>	Childress et al. 1980
Lampridiformes					
Trachipteridae				<i>Zu cristatus</i>	Olney and Naplin 1980
Regalecidae				<i>Regalecus glesne</i>	Montero et al. 1995
Ophidiiformes					
Bythitidae	vivip			<i>Brosmophycis marginata</i>	Hart 1973
Gadiformes	ovip	gonochore	none		
Moridae				<i>Antimora rostrata</i>	Jakobsdottir and Magnusson 2001
Macrouridae				<i>Coryphaenoides spp</i>	Stein and Percy 1982
Merlucciidae				<i>Merluccius productus</i>	McFarlane and Saunders 1997
Batrachoidiformes	ovip				
Batrachoididae		gonochore	paternal	<i>Porichthys notatus</i>	DeMartini 1988b, 1990, Brantley and Bass 1994
Lophiiformes	ovip				
Melanocetidae		gonochore	none	<i>Melanocetus johnsonii</i>	Pietsch 1976
Oneirodidae		gonochore	none	<i>Oneirodes eschrichtii</i>	Pietsch 1976
Mugiliformes	ovip				
Mugilidae		gonochore	none	<i>Mugil cephalus</i>	Greeley et al. 1987
Atheriniformes	ovip		none		
Atherinopsidae		gonochore	none	<i>Leuresthes tenuis</i>	Griem and Martin 2000
Beloniformes		gonochore			
Belonidae	ovip			<i>Strongylura exilis</i>	Ambrose and Moser 1988
Scomberesocidae	ovip		none	<i>Cololabis saira</i>	Kosaka 2000
Gasterosteiformes	ovip	gonochore	paternal		
Aulorhynchidae				<i>Aulorhynchus flavidus</i>	Marliave 1976
Gasterosteidae				<i>Gasterosteus aculeatus</i>	Wootton 1984
Scorpaeniformes		gonochore			
Scorpaenidae	ovip		none		
Scorpaeninae	vivip			<i>Scorpaena guttata</i>	Orton 1955
Sebastinae	vivip			<i>Sebastes flavidus</i>	Hopkins et al. 1995
Sebastobinae	ovip		none	<i>Sebastolobus alascanus</i>	Erickson and Pikitch 1993

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Anoploplatidae	ovip	gonochore	paternal	<i>Anoplopoma fimbria</i>	Hunter et al. 1989
Hexagrammidae	ovip	gonochore	paternal	<i>Oxylebius pictus</i>	DeMartini and Anderson 1980
Rhamphocottidae	ovip	gonochore	paternal	<i>Rhamphocottus richardsoni</i>	Munehara et al. 1999
Scorpaenichthyidae	ovip	gonochore	maternal	<i>Scorpaenichthys marmoratus</i>	Lauth 1989
Psychrolutidae	ovip	gonochore	none	<i>Hemilepidotus hemilepidotus</i>	DeMartini and Patten 1979
		gonochore	paternal	<i>Clinocottus acuticeps</i>	Marliave 1981b
Liparidae	ovip	gonochore		<i>Liparis fucensis</i>	DeMartini 1978
Perciformes		simultaneous	none		
Moronidae	ovip	gonochore		<i>Morone saxatilis</i>	Scofield 1931, Woodhull 1947
Serranidae					
<i>Paralabrax</i> spp		?protogynous		<i>Paralabrax maculatofasciatus</i>	Hastings 1989, Hovey and Allen 2000
		gonochore	none	<i>Paralabrax clathratus</i>	Smith and Young 1966
		gonochore	none	<i>Paralabrax nebulifer</i>	Oda et al. 1993, Baca Hovey et al. 2002
Malacanthidae	ovip	gonochore	none	<i>Caulolatilus princeps</i>	Elorduy-Garay and
Coryphaenidae	ovip	gonochore	none	<i>Coryphaena hippurus</i>	Oxenford 1999
Carangidae	ovip	gonochore	none	<i>Trachurus symmetricus</i>	Macewicz and Hunter 1993
Bramidae	ovip	gonochore	none	<i>Brama japonica</i>	Yoon and Shimazaki 1981
Sciaenidae	ovip	gonochore	none	<i>Seriphus politus</i>	DeMartini 1991
Embiotocidae	vivip	gonochore	none	<i>Embiotoca jacksoni</i>	Baltz 1984
Labridae	ovip	protogynous	none	<i>Bodianus pulcher</i>	Warner 1975a, Cowen 1990
		protogynous	none	<i>Halichoeres semicinctus</i>	Adreani and Allen 2008
		gonochore-2	none	<i>Oxyjulis californica</i>	Diener 1976
Bathymasteridae	ovip	?gonochore	paternal	<i>Rathbunella hypoplecta</i>	Fitch and Lavenberg 1975
Stichaeidae	ovip	gonochore	paternal	<i>Xiphister atropurpureus</i>	Marliave and DeMartini 1977
			maternal	<i>Anoplarchus purpureus</i>	Coleman 1992
Cryptacanthodidae	ovip	?gonochore	?	<i>Cryptacanthodes bergi</i>	Shiogaki 1982
Pholidae	ovip	gonochore	biparental	<i>Pholis laeta</i>	Hughes 1986
Anarrichadidae	ovip	?	biparental	<i>Anarrhichthys ocellatus</i>	Marliave 1987
Zaproridae	ovip	?	?	<i>Zaprora silenus</i>	Fitch and Lavenberg 1971
Trichodontidae	ovip	?gonochore	none	<i>Trichodon trichodon</i>	Marliave 1981c, Okiyama 1990
Trichonotidae	ovip	protogynous	none	<i>Trichonotus filamentosus</i>	Kusen et al. 1991
Ammodytidae	ovip	?gonochore	none	<i>Ammodytes hexapterus</i>	Robards et al. 1999
Clinidae	ovip	gonochore	paternal	<i>Heterostichus rostratus</i>	Coyer 1982
Blenniidae	ovip	gonochore	paternal	<i>Hypsoblennius</i> spp	Stephens et al. 1970
Icosteidae	ovip	gonochore	none	<i>Icosteus aenigmaticus</i>	Fitch and Lavenberg 1971
Gobiesocidae	ovip	protogynous	paternal	<i>Gobiesox maeandricus</i>	Marliave and DeMartini 1977
Gobiidae	ovip		paternal	<i>Rhinogobiops nicholsii</i>	Ebert and Turner 1962, Cole 1983
		bidirectional			
		simultaneous	paternal	<i>Lythrypnus</i> spp	St. Mary 2000
		gonochore	biparental	<i>Lythrypnus</i> spp	St. Mary 2000
		gonochore	paternal	<i>Clevelandia ios</i>	Brothers 1975
		gonochore	?paternal	<i>Typhlogobius californiensis</i>	MacGinitie 1939
Sphyraenidae		gonochore	none	<i>Sphyraena argentea</i>	Walford 1932
Scombridae	ovip	gonochore	none	<i>Thunnus albacares</i>	Schaefer 1998
Xiphiidae	ovip	gonochore	none	<i>Xiphias gladius</i>	DeMartini et al. 2000
Istiophoridae	ovip	gonochore	none	<i>Istiophorus</i> spp	DeSylva and Breder 1997

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Stromateidae	ovip	gonochore	none	<i>Peprilus simillimus</i>	Goldberg 1981b
Pleuronectiformes	ovip	gonochore	none		
Paralichthyidae				<i>Citharichthys spp</i>	Goldberg and Pham 1987
Pleuronectidae				<i>Microstomus pacificus</i>	Hunter et al. 1992
Cynoglossidae				<i>Symphurus atricaudus</i>	Goldberg 1981a
Tetraodontiformes	ovip				
Balistidae		gonochore	maternal	<i>Balistes polylepis</i>	Strand 1978
Diodontidae		?	none	<i>Diodon holacanthus</i>	Sakamoto and Suzuki 1978