

Calcified structures Collections

Instituto Español de Oceanografía (IEO) Spain

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Balears, Canarias

IEO: Laboratories, Species and Areas

IEO (9 laboratories): 7 lab. analyse calcified structures of species from ICES area, Mediterranean Sea, CECAF area, NAFO area and ICCAT area (Tuna).

Laboratories : Santander, Vigo, Cadiz, Málaga, Murcia, Baleares and Canarias



Species and Geographical areas (ICES area)

Species	Scientific Name	Area/stock	Type of structure	Maximum reported age (IEO data base)	Data collection (period of years)	Number of otoliths (extracted)
	<i>Engraulis encrasicolus</i>	VIIIc, VIIIb, VIIIa	Otolith	5	1985-2014	44005
	<i>Engraulis encrasicolus</i>	IXa North	Otolith	5	1995, 2011	2000
	<i>Engraulis encrasicolus</i>	IXa South	Otolith	3	1988-2014	40196
	<i>Sardina pilchardus</i>	VIIIc-IXa	Otolith	14	1981-2014	100564
	<i>Scomber scombrus</i>	VIIIc, IXa North	Otolith	18	1982-2014	60000
	<i>Scomber scombrus</i>	VIIIb, VII	Otolith	19	1982-2014	5000
Pelagic Species	<i>Scomber Colias</i>	VIIIc, VIIIb, and IXa North	Otolith	12	2011-2014	7304
	<i>Trachurus trachurus</i>	IXa North	Otolith	30	1982-2014	16000
	<i>Trachurus trachurus</i>	VIIIc, VIIIb	Otolith	30	1982-2014	55000
	<i>Trachurus mediterraneus</i>	VIIIc, VIIIb, and IXa North	Otolith	14	2006-2014	2626
	<i>Micromesistius poutassou</i>	VIIIc-IXa	Otolith	15	1982-2014	50000
						382695
	<i>Merluccius merluccius</i>	VI, VII, VIII, IXa	Otolith		1980-2014	125351
	<i>Trisopterus luscus</i>	VIII, IXa	Otolith	6	2003-2014	11538
	<i>Glyptocephalus cynoglossus</i>	VI, VII	Otolith	10	2009-2010	507
	<i>Helicolenus dactylopterus</i>	VI, VII, VIII, IXa	Otolith	25	2009-2014	2853
	<i>Conger conger</i>	VI, VII, VIII, IXa	Otolith/vertebrae	15	2009-2014	2058
Demersal Species	<i>Molva molva</i>	VI, VII, VIII, IXa	Otolith	13	2010-2014	1188
	<i>Molva macrophthalma</i>	VI, VII, VIII, IXa	Otolith	12	2009-2010	726
	<i>Phycis blennoides</i>	VI, VII, VIII, IXa	Otolith	10	2009-2014	2260
	<i>Pollachius pollachius</i>	IXa	Otolith	10	2011-2014	581
	<i>Aspitrigla cuculus</i>	VI, VII, VIII, IXa	Otolith	3	2009-2013	283
	<i>Microchirus variegatus</i>	VI, VII, VIII, IXa	Otolith	9	2009-2013	99
	<i>Gadus morhua</i>	ICES Subarea I ,II	Otolith	19	1995-2014	22140
	<i>Alepocephalus bairdii</i>	ICES Divs. XII, VI b	Otolith		2000-2014	17057
	<i>Coryphaenoides rupestris</i>	ICES Divs. XII, VI b	Otolith		1996-2014	21667
	<i>Sebastes mentella</i>	ICES Divs. XII, XIVb	Otolith		1995-2014	11005
						219313
Deep water species	<i>Pagellus bogaraveo</i>	Ixa South (Strait of Gibraltar)	Otolith	10*	1997-1999, 2003-2009, 2014	5000
						5000
	<i>Lophius piscatorius</i>	VIIb-k, VIIIa,b,d	Illicia	~20	2004-2014	2000
	<i>Lophius piscatorius</i>	VIIIc, IXa	Illicia	~20	1996-2014	12000
	<i>Lophius budegassa</i>	VIIb-k, VIIIa,b,d	Illicia	-	2004-2014	2000
Benthonic Species	<i>Lophius budegassa</i>	VIIIc, IXa	Illicia	-	1996-2014	12000
	<i>Lepidorhombus whiffiagon</i>	VIIb-k, VIIIa,b,d	Otolith	14	1990-2014	15000
	<i>Lepidorhombus whiffiagon</i>	VIIIc, IXa	Otolith	14	1990-2014	15000
	<i>Lepidorhombus boscii</i>	VIIIc, IXa	Otolith	12	1990-2014	15000
						73000
Total	27 species/ 33 stocks	I, II, VI, VII, VIII, IXa, XII	otolith/Illicia /vertebrae		1980-2014	680008

Species and Geographical areas (ICES area)

Species from ICES area: Total 27 species/ 33 stocks

- " Pelagic Species: 7 species/ 9 stocks
- " Demersal Species: 15 species/ 16 stocks
- " Deep water Species: 1 species/1 stock
- " Benthic Species: 4 species/ 7 stocks

Species, Max reported age and good collections:

Horse mackerel,	30 years,	1982-2014,
Hellicolenus	25 years,	2009-2014
Mackerel	19 years,	1982-2014
Cod	19 years	1995-2014
Sardine	15 years,	1981-2014
Blue waiting	15 years,	1981-2014
Sebastes	No aged	1995-2014
Baird's smooth-head	No aged	2000-2014
Roundnose grenadier	No aged	1996-2014
Hake,	Problems with age,	1980-2014
Anglerfish	Problems with age	1996-2014

Species and Geographical areas (Mediterranean area)

Species	Scientific Name	Area/stock	Type of structure	Maximum reported age (IEO data base)	Data collection (period of years)	Number of otoliths (extracted)
	<i>Engraulis encrasicolus</i>	GSA01	Otolith	3	2003-2014	12200
	<i>Engraulis encrasicolus</i>	GSA06	Otolith	3	2003-2014	15000
Pelagic Species	<i>Sardina pilchardus</i>	GSA01	Otolith	8	2003-2014	15300
	<i>Sardina pilchardus</i>	GSA06	Otolith	8	2003-2014	17900
	<i>Scomber Colias</i>	GSA06	Otolith		2009-2014	
	<i>Trachurus trachurus</i>	GSA01	Otolith	15	2003-2014	7000
	<i>Trachurus mediterraneus</i>	GSA01	Otolith	11	2003-2014	5000
	<i>Micromesistius poutassou</i>	GSA06	Otolith		2009-2014	
	<i>Merluccius merluccius</i>	Mediterranean	Otolith	6	1994-2014	21500
	<i>Mullus Barbatus</i>	GSA01, GSA05	Otolith	5	2003-2005,2007-2013	5000
	<i>Mullus surmuletus</i>	GSA05	Otolith	6	2003-2013	9000
Demersal Species	<i>Chelidonichthys cuculus</i>	GSA05	Otolith	5	2001-2002	150
	<i>Chelidonichthys lastoviza</i>	GSA05	Otolith	4	2001-2002	325
	<i>Serranus cabrilla</i>	GSA05	Otolith	6	2001-2002	375
	<i>Trachinus draco</i>	GSA05	Otolith	9	2001-2002	385
	<i>Uranoscopus scaber</i>	GSA05	Otolith			80
						36815
Total	14 species/17 stocks	Mediterranean	Otolith		1994-2014	109215

Species and Geographical areas (Mediterranean area)

Species from Mediterranean area: Total 14 species/ 17 stocks

” Pelagic Species: 5 species/ 7 stocks

” Demersal Species: 8 species/ 9 stock

Species, Max reported age and good collections:

Horse mackerel	15 years,	2003-2014
Medit. Horse mackerel	11 years	2003-2014
Sardine	8 years	2003-2014
Mullus surmuletus	6 years	2003-2013
Hake	Problems with age	1994-2014

Species and Geographical areas (ICCAT area, Tuna)

Species	Scientific Name	Area/stock	Type of structure	Maximum reported age (IEO data base)	Data collection (period of years)	Number of otoliths (extracted)
	<i>Auxis rochei</i>	Western Mediterranean (BIL 95)	Otolith, vertebrae, spine	5	2004-2014	500/500/500
	<i>Euthynnus alleterattus</i>	Western Mediterranean (BIL 95)	Otolith, vertebrae, spine	7	2004-2014	500/500/501
Large Pelagic Species	<i>Sarda sarda</i>	Western Mediterranean (BIL 95)	Otolith, vertebrae, spine	6	2004-2014	500/500/502
	<i>Thunnus alalunga</i>	Western Mediterranean (BIL 95)	Otolith/ Spine	8	2004-2014	200/2000
	<i>Thunnus thynnus</i>	Eastern Atlantic and Western Mediterranean (BIL 95, BFT54/58/59)	Spine/otolith/vertebrae	24	1979-2014	10000/500/400
	<i>Xiphias gladius</i>	Western Mediterranean (BIL 95)	Spine		2004-2014	1000
	<i>Thunnus alalunga</i>	North Atlantic stock (AL 31)	First dorsal fin first fin ray		1990-2013	6000
						20757
Total	6 species/6 stocks	Western Mediterranean (BIL 95)- Atlantic	Otolith, vertebrae, spine		1979-2014	20757

Species from ICCAT area:

” Large Pelagic Species: 6 species/ 6 stocks

Species, Max reported age and good collections:

Red Tuna 24 years, 1979-2014

Species and Geographical areas (CECAF area)

Species	Scientific Name	Area/stock	Type of structure	Maximum reported age (IEO data base)	Data collection (period of years)	Number of otoliths (extracted)
Pelagic Species	<i>Sardina pilchardus</i>	FAO 34.1.1	Otolith	10	1976-1999	43200
						43200
Demersal Species	<i>Merluccius polli + M. senegalensis</i>	Morocco to Angola	Otolith		2002-2012	10000
	<i>Merluccius merluccius</i>	Morocco	Otolith		1989-2006	4000
						14000
Total	4 species/4 stocks	Morocco to Angola	Otolith		1976-2012	57200

Species from CECAF area: Total 4 species/ 4 stocks

“Pelagic Species: 1 species/ 1 stocks

“Demersal species: 3 species / 3 stocks

Species, Max reported age and good collections:

Sardine 10 years, 1976-1999

Species and Geographical areas (NAFO area & Argentine)

Species	Scientific Name	Area/stock	Type of structure	Maximum reported age (IEO data base)	Data collection (period of years)	Number of otoliths (extracted)
	<i>Merluccius hubbsi</i>	Atlantic, Southwest (42, 46, 49, MW, MS, MN)	Otolith		1990-2014	(+) 24724
	<i>Gadus morhua</i>	Atlantic, West (NAFO, Divs.3LMNO)	Otolith	20	1993-2014	17897
Demersal Species	<i>Hippoglossoides platessoides</i>	Atlantic, West (NAFO, Divs.3LMNO)	Otolith		1991-1992; 2001-2014	17301
	<i>Macrourus berglax</i>	Atlantic, West (NAFO, Divs.3LMNO)	Otolith	29	1990-2014	37806
	<i>Reinhardtius hippoglossoides</i>	Atlantic, West (NAFO, Divs.3LMNO)	Otolith	23	1990-2014	117534
						190538
Total	5 species /5 stocks	NAFO area and Argentine waters	Otolith		1990-2014	190538

Species from NAFO area: Total 4 species/ 4 stocks

Species from Argentine waters: 1 species/ 1 stock

Species, Max reported age and good collections:

Cod	20 years,	1993-2014
Macrourus	29 years	1990-2014
Greenland halibut	23 years	1990-2014

Techniques Development

Annual Growth: All species, mainly for stock assesment

“Whole otoliths: Anchovy, Sardine, Mackerel, Blue Whiting, Witch, Blue-mouth rockfish, ling, Aspitrigla cuculus, Megrim, Four-spot-megrim and Red (blackspot) seabream.

“Sectioned otoliths: Horse Mackerel, Hake, Pouting, Conger, Bluemouth rockfish, Pollack, Greater forkbeard, Blue ling, Ling, and some Tuna species.

“Sectioned Illicia (dorsal fin ray): White Anglerfish and Black Anglerfish

“Whole vertebrae: Conger

“Sectioned spine, vertebrae: Tuna species

Daily Growth: Mackerel, Anchovy, Sardine and Hake for environmental studies and validation of first growth ring.

“Polished Sectioned otoliths: juveniles of Mackerel, Anchovy, Hake, Sardine

“Whole otolith: larvae and post-larvae mackerel, anchovy, sardine

Images Processing:

“For daily growth studies routine: VISILOG 6.4- TNPC 4.2

“For Verification of annual growth: NIS-Elements-D 3.0; NIS Elements BR Version 2.10

“For otolith/illicia/spine Exchanges: Gimp 2.6; Paint shop Pro 9. WebGR

Validation/Corroboration Methods

Tagging studies:

" Merluccius merluccius from VIIIc-IXa: *Piñeiro et al, 2007*

" Lophius piscatorius from VII, VIII, IXa: *Landa et al., 2008*

" Pagellus bogaraveo from IXa South: *Gil et al., 2009*

Captive rearing:

" Engraulis encrasicolus: *Cermeño et al., 2003; Aldanondo et al., 2008*

" Sardina pilchardus: *Aleman and Alvarez, 1994*

Growth ring formation studies (Marginal increment analysis/Edge zone analysis, Progression of strong year-classes, ò):

" Lepidorhombus whiffiagonis: from VII, VIII, IXa: *Landa and Piñeiro, 2000*

" Trachurus trachurus: from VII, VIII. *Abaunza et al., 2003*

" Engraulis encrasicolus: from Subarea VIII. *Uriarte et al., 2014*; from Div Ixa, Millan & Tornero, 2009

" Scomber Colias: from VIIIc. *Navarro et al., 2014*

Firts growth ring studies fom the daily increments

" Engraulis encrasicolus: from Subarea VIII: *Hernandez et al., 2009, 2013*

Thank you very much!



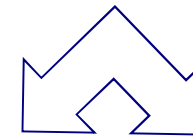
Remarks on annual age estimation of hake and anglerfish

Merluccius merluccius

- The previous international age estimation method was neither accurate nor precise and provided **overestimation of age due to an under estimation of growth** (by a factor of ~2) (De Pontual *et al.*, 2006; Piñeiro *et al.*, 2007; WKA EH 2009; ICES 2010).
- A replacement age estimation method with sufficient precision and accuracy is currently not available because of the insufficient validated data (WKROUND, 2010).

Lophius piscatorius & L. budegassa

- The illicia of both species have not been aged since 2007 due to inconsistencies found in cohort tracking (Azevedo *et al.*, 2008; ICES, 2008). It was mainly due to the international age estimation criterion was biased (**overestimation of age**) (Landa *et al.*, 2008).



L. piscatorius

L. budegassa

- A **new** faster growth rate and **growth parameters** was obtained based on results from tagging-recapture, daily growth and length frequency studies (Landa *et al.*, 2008).

Research in a new (and more accurate) illicia age estimation criterion is being currently performed.

- There are not enough evidences of growth studies (tagging-recapture, daily growth,...) alternative to the age estimation to estimate new growth parameters.

Therefore...

- An alternative **stock assessment** method less dependent on the estimation of age (**length based**) is currently in use (WGHMM, 2011).
- **Hard parts** (otoliths or illicia) are annually **collected** by IEO for research studies on growth and for developing a reliable age estimation method.

References

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