Common goby (*Pomatoschistus microps*)

MarLIN – Marine Life Information Network
Biology and Sensitivity Key Information Review

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The Marine Life Information Network, Marine Biological Association of the United Kingdom.

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***Pomatoschistus microps* on sand.**
Photographer: Paul Naylor

See online review for distribution map

Distribution data supplied by the Ocean Biogeographic Information System (OBIS). To interrogate UK data visit the NBN Atlas.

Researched by	Karen Riley	**Refereed by**	Angus Jackson
Authority	(Krøyer, 1838)		
Other common names	-	**Synonyms**	-

Summary

Description

The common goby is a small goby growing up to 6 cm in length. The top of the head, nape and throat are scaleless. It is grey or sandy in colour, often with darker blotches across the back and faint marks along the side of the body. There is also a dark area at the base of the pectoral fins and tail fin.

Recorded distribution in Britain and Ireland

The common goby is found along all British and Irish coasts.

Global distribution

Its worldwide distribution extends from the Baltic Sea, western Norway to the western Mediterranean.

Habitat

Pomatoschistus microps is an extremely abundant fish in Britain. It is often found in tide-pools, estuaries, salt marshes and brackish land-locked lagoons. Although the common goby prefers open water areas of bare muddy or sandy sediment, it is often found amongst dense vegetation.

Depth range

Down to 11 m.

Identifying features

- The anterior dorsal fin has 6 spines.
- The posterior dorsal has 1 spine and 8-10 rays.
- Pelvic fins are united to form a crescent-shaped disc.
- Eyes are large and positioned high on the side of the head.
- Upper rays of pectoral fins are not free distally.

Additional information

Pomatoschistus microps was once confused with the sand goby *Pomatoschistus minutus* but the common goby has a dark mark at the top of the base of the pectoral fin (Dipper, 2001). *Pomatoschistus microps* is a very abundant fish able to tolerate a wide range of salinity. However, it prefers low salinity areas. It resides throughout the British Isles in estuaries, saltmarshes, along the coastline and in intertidal pools. Its worldwide distribution extends from the Baltic Sea, western Norway to the western Mediterranean. The common goby migrates downstream, or into shallow waters, mainly at the onset of the breeding season, in spring.

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Biology review

Taxonomy

Phylum	Chordata	Sea squirts, fish, reptiles, birds and mammals
Class	Actinopterygii	Ray-finned fish, e.g. sturgeon, eels, fin fish, gobies, blennies, and seahorses
Order	Perciformes	
Family	Gobiidae	
Genus	Pomatoschistus	
Authority	(Krøyer, 1838)	
Recent Synonyms	-	

Biology

Typical abundance	High density
Male size range	11-64mm
Male size at maturity	ca 30 -40mm
Female size range	ca 30 -40mm
Female size at maturity	
Growth form	Pisciform
Growth rate	0.16 -0.27mm/day
Body flexibility	High (greater than 45 degrees)
Mobility	
Characteristic feeding method	Predator
Diet/food source	
Typically feeds on	Amphipods, isopods, polychaetes and chironomid larvae.
Sociability	
Environmental position	Demersal
Dependency	Independent.
Supports	None
Is the species harmful?	No

Biology information

The common goby is an important food source for both birds and larger fish. Adults feed at the surface of the sediment on amphipods, isopods, polychaetes and chironomid larvae, while the juveniles' diet consists largely of interstitial copepods.

Pomatoschistus microps matures early and has a short lifespan. Doornbos & Twisk (1987) reported a growth rate of 0.16 -0.27 mm/day. Its maximum age was found to be between 19 and 26 months in the Atlantic (Bouchereau & Guelorget, 1998; Miller, 1986; Miller, 1975), with most adults dying in the second autumn of life (Miller, 1975). In the Mediterranean the lifespan is reported as between 12 and 14 months (Bouchereau & Guelorget, 1998). The common goby is small, measuring up to 64 mm on British coasts (Jones and Miller, 1966) and 53 mm in the Mediterranean (Bouchereau *et al.*, 1989).

Habitat preferences

Physiographic preferences	Open coast, Estuary, Isolated saline water (Lagoon), Enclosed coast / Embayment
Biological zone preferences	Sublittoral fringe
Substratum / habitat preferences	Coarse clean sand, Fine clean sand, Gravel / shingle, Mixed, Mud, Muddy sand, Pebbles, Rockpools, Saltmarsh, Sandy mud
Tidal strength preferences	
Wave exposure preferences	Extremely sheltered, Moderately exposed, Sheltered, Very sheltered
Salinity preferences	Low (<18 psu), Reduced (18-30 psu), Variable (18-40 psu)
Depth range	Down to 11 m.
Other preferences	
Migration Pattern	Seasonal (environment), Seasonal (reproduction)

Habitat Information

Pomatoschistus microps is a migratory fish, except where natural or man-made barriers prevent this. In the Atlantic the common goby can migrate for spawning, moving inshore for the breeding season, or to avoid low salinities (Miller, 1975) and temperatures (Nyman, 1953; Jones & Miller, 1966; Araujo *et al.*, 2000).

It can be found down to 11 m in depth but normally occurs at < 1 m. It may also follow the incoming tide up over mudflats. Along the coastline it moves into warmer, deeper water for the duration of winter (Barnes, 1994), in particular when sea temperatures drop below 5 °C, but not where minimum sea temperature is above 7 °C (Miller, 1975).

The common goby lives in estuary channels where current flow can be considerable. In estuaries the it migrates downstream during the breeding season and also with the onset of maturation (Miller, 1975). In the Mediterranean they tend to be less mobile.

Life history

Adult characteristics

Reproductive type	Gonochoristic (dioecious)
Reproductive frequency	Annual protracted
Fecundity (number of eggs)	100-1,000
Generation time	1-2 years
Age at maturity	7 months to a year
Season	April - September
Life span	1-2 years

Larval characteristics

Larval/propagule type	-
Larval/juvenile development	Oviparous

Duration of larval stage	2-10 days
Larval dispersal potential	Greater than 10 km
Larval settlement period	Insufficient information

Life history information

Longevity was reported as 1.6 to 2 years (Miller, 1986). Common gobies breed in their first year of life, becoming sexually mature at approximately 7 months to one year old (Miller, 1986). They attach their eggs onto the upper surface of the interior of an empty bivalve shell, preferring that of *Mya arenaria*. The male guards the nest and fans the eggs with his tail, to oxygenate them while they are developing.
In the Atlantic, reproduction is protracted (Bouchereau & Guelorget, 1998; Rogers, 1989) and in the Mediterranean it is contracted (Bouchereau & Guelorget, 1998). The breeding season in south west Britain is from mid-April to August/September (Miller, 1986; Rogers, 1989) and between May and July in the Mediterranean (Bouchereau *et al.*, 1989). The common goby spawns at temperatures between 10 and 20 °C (Fonds & van Buurt, 1974).
The common goby has a high individual fecundity and multiple spawning. Rogers (1988) observed 10 batches of eggs in a 16 week breeding season, while Miller (1979) and Bouchereau & Guelorget (1998) observed between 9 and 11 in an entire breeding season. Fecundity was noted to be between 650 and 3,400 by Miller (1986) and between 460 and 2,030 by Bouchereau *et al.* (1989).
Pampoulie *et al.* (2000) observed the effects of a drastic and prolonged decrease in salinity, from ca 14 to 5 g/l in less than a week, sustained for approximately four years, and an increase in turbidity due to a centennial flood in the Rhone river. It was reported that these conditions led to an increase in the fecundity per spawning act and egg size of the population. Eggs and larvae of the common goby survive well at salinities as low as 5 psu (Fonds, 1973).

Sensitivity review

This MarLIN sensitivity assessment has been superseded by the MarESA approach to sensitivity assessment. MarLIN assessments used an approach that has now been modified to reflect the most recent conservation imperatives and terminology and are due to be updated by 2016/17.

Physical Pressures

	Intolerance	Recoverability	Sensitivity	Confidence
Substratum Loss	Intermediate	High	Low	Moderate

Pomatoschistus microps lives and forages on a variety of substrata. It requires rockpools in the intertidal to survive at low tide. Therefore, loss of rockpools (for instance by infilling) or loss of substrata (for instance by spoil dumping or land claim) will most likely cause a proportion of the species population to die. However, at high tide, or where the movement of fish is not restricted, adults are sufficiently mobile and will be able to recolonize areas which contain suitable substrata. Intolerance is therefore recorded as intermediate. Recoverability is likely to be high (see additional information section below).

Smothering	Intermediate	High	Low	Moderate

Pomatoschistus microps will not be affected by smothering as they are mobile and able to swim away. Cordone & Kelley (1961) reported that (in a freshwater habitat) deposition of sediment on the bottom of the substratum would destroy needed shelter, reduce the availability of food, impair growth and lower the survival rate of eggs and larvae of fish. It is likely that *Pomatoschistus microps* would be more intolerant if smothering occurred during the breeding season due to the probable destruction of broods of eggs. Materials such as concrete, oil or tar are likely to have a greater negative impact on the population. Intolerance to smothering is recorded as intermediate. Recoverability is likely to be high (see additional information section below).

Increase in suspended sediment	Low	Very high	Very Low	Low

Moore (1977) indicated that an increase in siltation can have a negative effect on the growth of adult fish, survival of eggs and larvae and pathological effects on gill epithelia. Juveniles have been reported as being more intolerant of siltation than adults (Moore, 1977). Bottom-dwelling species are generally found to be tolerant of suspended solids (Moore, 1977). Pampoulie *et al.* (2000) reported the fecundity and egg size increased with increased turbidity. Therefore, intolerance to siltation has been recorded as low. Recoverability is likely to be very high (see additional information section below).

Decrease in suspended sediment

Dessication	Not relevant	Not relevant	Not relevant	Not relevant

Pomatoschistus microps is found in shallow rockpools, estuaries, saltmarshes etc. The animal is soft-bodied, so stranding of the individual, and subsequent exposure to sunshine and air for an hour would more than likely result in death. However, the species is highly mobile and unlikely to be stranded. Therefore, not relevant has been recorded.

Increase in emergence regime	Not relevant	Not relevant	Not relevant	Not relevant

It is unlikely that *Pomatoschistus microps* would be affected by a change in the emergence regime as at high tide it forages near the shore and at low tide it inhabits rockpools.

Decrease in emergence regime

Increase in water flow rate Low Very high Very Low Low

Araujo *et al.* (2000) found that there was a negative correlation between water flow rate and abundance of the common goby in the upper Thames Estuary. This suggests that there is an upper limit to the flow rate that the common goby can withstand, however this value is not known. It is unlikely that they could withstand a large increase in water flow rate, as this would decrease their ability to feed and migrate. Therefore, intolerance to water flow rate is assessed as low. Recoverability is likely to be very high (see additional information section below).

Decrease in water flow rate

Increase in temperature Intermediate High Low Moderate

In the Atlantic, the common goby can migrate to avoid low temperatures (Nyman, 1953; Jones & Miller, 1966; Araujo *et al.*, 2000). However, Wiederholm (1987) suggested that a cold summer may reduce the population density and that a series of cold years may wipe out the northern-most population. The severe winter of 1962-63 in Morecambe showed a considerable reduction of *Pomatoschistus microps* (Jones & Miller, 1966). Similar effects were observed for the severe winters in the Dutch Wadden Sea in 1962-63 and 1963-64, where the population did not regain its abundance until 1965 (Fonds, 1973). However at Oxwich, near Swansea, *Pomatoschistus microps* was still fairly common in tidal pools after the winter of 1962-63 (Crisp, 1964).
A drastic short term increase in temperature would also be likely to affect the common goby population. The geographical distribution of *Pomatoschistus microps* extends from Britain to waters further south. The common goby populations in southern waters are therefore exposed to warmer waters. Long term increases in temperature due to climate warming would be unlikely to kill a proportion of the population, and may shift their distribution range further northwards.

Furthermore, Bouchereau *et al.* (1989) suggested that temperature seemed to take a prominent part in the condition of the common goby and its sexual cycle. A temperature increase is recorded as not relevant because it is unlikely that a proportion of the population will die. Whereas, a decrease in temperature is likely to cause a proportion of the population to die and is therefore recorded as intermediate. Recoverability is likely to be high (see additional information section below).

Decrease in temperature

Increase in turbidity Low Very high Very Low Moderate

With an increase in turbidity, the amount of light penetration decreases. The minimum light intensity needed for the detection and recognition of food are of great importance in many species of fish (Kinne, 1970). For instance if the organism needs to spend more time foraging for food, its energy expenditure will increase and could possibly lead to growth and reproductive problems. In highly turbid waters, fish larvae have been noted to show a greater than normal mortality. Gobies are visual predators. *Pomatoschistus microps* is an active carnivore and would need to compensate (reduction in reproduction, growth etc.) in some way for a greater amount of time needed for searching and capturing prey.
However, numbers of common goby increased from August 1989 and July 1990 due to high temperatures, salinity and low transparency (Araujo *et al.*, 2000). Unfortunately the level of turbidity at which this occurred was not reported. The common goby has also been noted for

demonstrating phenotypic plasticity in adverse environmental conditions (Pampoulie *et al.*, 2000). Pampoulie *et al.* (2000) observed the effects of a drastic and prolonged decrease in salinity, from 14 to 5 g/l in less than a week, sustained for approximately four years, and an increase in turbidity due to a centennial flood in the Rhone river. It was reported that these conditions led to an increase in the fecundity per spawning act, and egg size of the population. Therefore, intolerance to turbidity has been assessed as low. Recoverability is likely to be very high (see additional information section below).

Decrease in turbidity

Increase in wave exposure	Low	Very high	Very Low	Low

The common goby is sufficiently mobile to move away from the area undergoing changes in wave exposure, therefore it is assigned a low intolerance. Recoverability is likely to be very high (see additional information section below).

Decrease in wave exposure

Noise		Not relevant		Not relevant

Insufficient information.

Visual Presence	Low	Very high	Very Low	Low

Fish generally forage for food using visual methods and can detect differing levels of light and shade. It is therefore probable that *Pomatoschistus microps* can also detect these changes and would be slightly affected by activity on the shore, more so in the breeding season. However, periods of time when activity might be reduced due to hiding would most likely be slight. A low intolerance has been recorded. Recoverability is likely to be very high (see additional information section below).

Abrasion & physical disturbance	Not relevant	Not relevant	Not relevant	Not relevant

Pomatoschistus microps is sufficiently mobile to avoid abrasive contact and to shelter from it. Therefore the common goby is unlikely to suffer from abrasion and physical disturbance.

Displacement	Low	Very high	Very Low	Low

If displaced onto other suitable substrata, no effects on the population are expected. However, if displacement occurs during the breeding season, negative effects could be noted. Furthermore, if a male that is protecting fertilized eggs is displaced, the eggs are not likely to survive. Therefore, a low intolerance has been recorded. Recoverability is likely to be high (see additional information section below).

Chemical Pressures

	Intolerance	Recoverability	Sensitivity	Confidence
Synthetic compound contamination	Intermediate	High	Low	Moderate

Lindane is likely to bioaccumulate significantly and is considered to be highly toxic to fish (Cole *et al.*, 1999). Ebere & Akintonwa (1992) conducted experiments on the toxicity of various pesticides to *Gobius* sp. They found Lindane and Diazinon to be very toxic, with 96 hr LC_{50s} of 0.25 µg/l and 0.04 µg/l respectively. TBT is very toxic to algae and fish. However, toxicity of TBT is highly variable with 96-hr LC_{50} ranging from 1.5 to 36 µg/l, with larval stages being more sensitive than adults (Cole *et al.*, 1999). PCBs are highly persistent in the water column and sediments, have the potential to bioaccumulate significantly and can be very toxic to marine invertebrates. However their toxicity to fish is not clear (Cole *et al.*, 1999). Therefore, an intermediate intolerance has been recorded. Recoverability is likely to be high (see Additional Information section below).

Heavy metal contamination High High Moderate Low

Cadmium, mercury, lead, zinc and copper are highly persistent, have the potential to bioaccumulate significantly and are all considered to be very toxic to fish (Cole *et al.*, 1999). Mueller (1979) found that in *Pomatoschistus* sp., very low concentrations of cadmium, copper and lead (0.5 g/l Cd^{2+}; 5 g/l Cu^{2+}; 20 g/l Pb^{2+}) brought about changes in activity and an obstruction to the gill epithelia by mucus.
Inorganic mercury concentrations as low as 30 µg/l (96-h LC_{50}) are considered to be toxic to fish, whereas organic mercury concentrations are more toxic to marine organisms (World Health Organisation, 1989, 1991). Oertzen *et al.* (1988) found that the toxicity of the organic mercury complex exceeded that of $HgCl_2$ by a factor of 30 for *Pomatoschistus microps*. Therefore, a high intolerance to heavy metals has been recorded. Recoverability is likely to be high (see Additional Section below).

Hydrocarbon contamination Intermediate High Low Moderate

Toxicity of low molecular weight poly-aromatic hydrocarbons (PAH) to organisms in the water column is moderate (Cole *et al.*, 1999). They have the potential to accumulate in sediments and, depending on individual PAH, to be toxic to sediment dwellers at levels between 6 and 150 µg/l (Cole *et al.*, 1999). The toxicity of oil and petrochemicals to fish ranges from moderate to high (Cole et al., 1999). The main problem is due to smothering of the intertidal habitat. Bowling *et al.* (1983) found that anthracene, a PAH, had a photo-induced toxicity to the bluegill sunfish. In fact, they reported that when exposed to sunlight anthracene was at least 400 times more toxic than when no sunlight was present. According to Ankley *et al.* (1997) only a subset of PAH's are phototoxic (fluranthene, anthracene, pyrene etc.). Effects of these compounds are destruction of gill epithelia, erosion of skin layers, hypoxia and asphyxiation (Bowling *et al.*, 1983). It is possible that *Pomatoschistus microps* could be similarly intolerant of hydrocarbons, however this is not known. An intermediate intolerance to hydrocarbons has been recorded. Recoverability is likely to be high (see Additional Information section below).

Radionuclide contamination Intermediate High Low Very low

Kinne (1984) reported that for the marine goby, *Chasmichthys glosus*, doses of as little as 100 rad (type not known) produced a readily observable response, causing severe damage to gonads of both males and females. The testes showed slightly greater intolerance. It is probable that *Pomatoschistus microps* would respond similarly to sublethal irradiation at levels indicated above. Intolerance to radionuclides is recorded as intermediate. Recoverability is likely to be high (see Additional Information section below).

Changes in nutrient levels Not relevant

No information was available concerning the common goby and its intolerance to nutrient levels. However, it is probably relatively tolerant of variations in nutrient concentrations.

Increase in salinity Low Very high Very Low Low

In the Atlantic the common goby can migrate to avoid low salinities (Miller, 1975). Pampoulie *et al.* (2000) observed the effects of a drastic and prolonged decrease in salinity for *Pomatoschistus microps*. Due to a centennial flood in the Rhone river, the salinity dropped from ca 14 to 5 g/l n less than a week, with this level being sustained for approximately four years. It was reported that these conditions led to an increase in the fecundity per spawning act and egg size of the population. Population levels of *Pomatoschistus microps* decreased, yet during the years 1993 to 1995 an increase in fecundity and egg size was recorded in order to increase

the population enormously (Pampoulie *et al.*, 2000). Fonds (1973) found that eggs and larvae of the common goby survive well at salinities as low as 5 psu. Therefore, although *Pomatoschistus microps* may suffer slightly from a change in salinity, it has been shown to adapt its reproductive strategy to compensate for this.
Pomatoschistus microps has been recorded in salinities as low as 4 psu (Barnes, 1994) and has been noted to tolerate salinities from about 8 to 80 psu (Fish & Fish). Therefore a low intolerance has been recorded. Recoverability is likely to be very high (see additional information section below).

Decrease in salinity

Changes in oxygenation	Low	Very high	Very Low	Low

Oxygen levels may change drastically over a tidal cycle in a rockpool. *Pomatoschistus microps* is likely to be well-adapted to these changes. Oertzen & Avon (1982) found that the goby retained its standard metabolic rate down to an oxygen saturation of 36%. However, a decrease in oxygen below this level would be expected to have a slight negative impact on the population. Therefore, intolerance to decreased oxygenation is assessed as low. Recoverability is likely to be very high (see Additional Information section below).

Biological Pressures

	Intolerance	Recoverability	Sensitivity	Confidence
Introduction of microbial pathogens/parasites	Low	High	Low	Moderate

Pampoulie *et al.* (2000b) found that the trematode *Aphalloides coelomicola* was found in *Pomatoschistus microps* in the Vaccares lagoon (delta du Rhone, France). They suggested that *Pomatoschistus microps* is both its second intermediate and final host, with the transfer mechanism to the first intermediate host through the death of the definitive host. *Cryptocototyle concavum* has been noted to have a very high infestation rate in *Pomatoschistus microps* (Zander *et al.*, 1993). *Hysterothylacium* sp. (Nematoda), and *Podocotyle atomon* were also noted by Zander *et al.* (1993) to infest the sand goby, in the SW Baltic Sea. Specific effects of the parasites on *Pomatoschistus microps* are not known, but it is likely that they will cause a reduction in the fish's fitness. Therefore, a low intolerance has been recorded. Recoverability is likely to be high (see Additional Information section below).

Introduction of non-native species	Not relevant	Not relevant	Not relevant	Not relevant

No alien or non-native species are known to affect *Pomatoschistus microps* in Britain and Ireland.

Extraction of this species	Not relevant	Not relevant	Not relevant	Not relevant

Pomatoschistus microps is unlikely to be subject to a target fishery. Therefore, not relevant has been recorded (see additional information section below).

Extraction of other species	Low	Very high	Very Low	Moderate

Extraction of bivalves e.g. *Mytilus*, *Mya* and *Cerastoderma* species may reduce nest availability (Angus Jackson, pers comm.). Nest availability can affect the sex ratio (Borg *et al.* (2002). Therefore, an intolerance of low has been recorded with a very high recoverability (see below).

Additional information

The common goby has a high individual fecundity and multiple spawning. Rogers (1988) observed

10 batches of eggs in a 16 week breeding season, while Miller (1979) and Bouchereau & Guelorget (1998) observed between 9 and 11 in an entire breeding season. Fecundity was noted to be between 650 and 3,400 eggs by Miller (1986). Gobies have a high fecundity and a long breeding season. They are also widespread, with potentially good dispersal due to their high adult mobility and pelagic larval phase. Therefore, they would probably recolonize an area rapidly.

Importance review

Policy/legislation

Berne Convention	Appendix III
IUCN Red List	Least Concern (LC)

Status

National (GB) importance	Not rare/scarce	**Global red list (IUCN) category**	Least Concern (LC)

Non-native

Native	-		
Origin	-	**Date Arrived**	Not relevant

Importance information

Pomatoschistus microps is protected under the Bern Convention, Appendix III (Protected Fauna Species). Under this, the species is protected, but a certain exploitation is possible if the population level permits.

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