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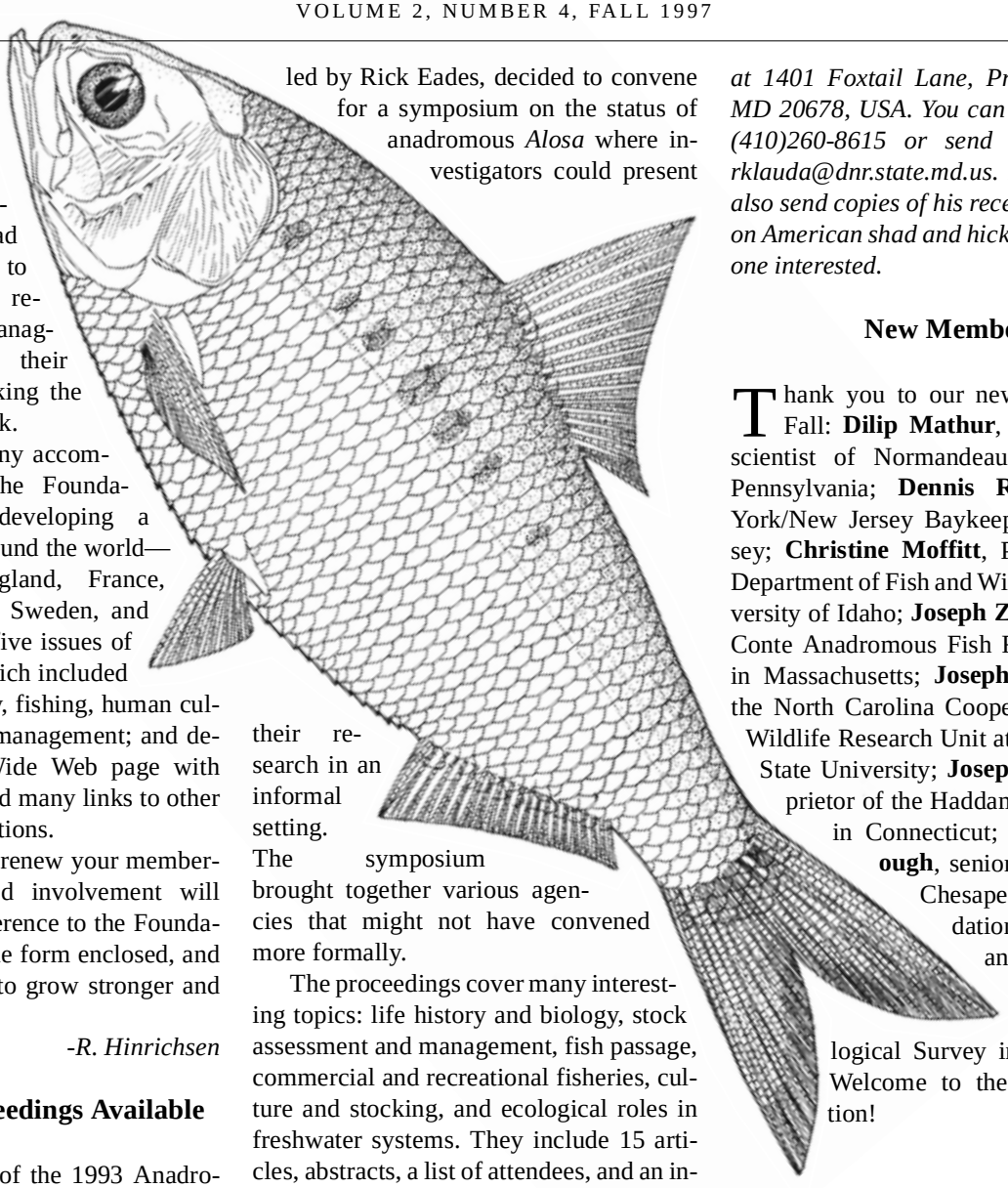
■ THE SHAD FOUNDATION'S ■

SHAD JOURNAL

"For the study, protection, and celebration of shad around the world"

Shad in Iranian waters
American shad museum opened
Arabian Gulf estuary invaded

VOLUME 2, NUMBER 4, FALL 1997



President's Note:

As we celebrate the first anniversary of the Shad Journal, I would like to say thanks to all the researchers, fishers, managers and others for their support, and for making the Shad Foundation work.

We can count many accomplishments during the Foundation's first year: developing a membership from around the world—USA, Canada, England, France, China, Kuwait, Iraq, Sweden, and Norway; publishing five issues of the *Shad Journal*, which included 17 articles on biology, fishing, human culture, education, and management; and developing a World Wide Web page with useful information and many links to other shad-related organizations.

It may be time to renew your membership. Your continued involvement will make a world of difference to the Foundation. Please fill out the form enclosed, and help the Foundation to grow stronger and more vibrant in 1998.

-R. Hinrichsen

Conference Proceedings Available

The Proceedings of the 1993 Anadromous *Alosa* Symposium, held at the seventh annual meeting of the Tidewater Chapter of the American Fisheries Society Tidewater Chapter, in Virginia are available. In 1990, several chapter members, led by Rick Eades, decided to convene for a symposium on the status of anadromous *Alosa* where investigators could present their research in an informal setting. The symposium brought together various agencies that might not have convened more formally.

The proceedings cover many interesting topics: life history and biology, stock assessment and management, fish passage, commercial and recreational fisheries, culture and stocking, and ecological roles in freshwater systems. They include 15 articles, abstracts, a list of attendees, and an introduction by John E. Cooper, State University of New York in Syracuse, New York.

You may order the proceedings for $15.00 (US) by writing Ronald J. Klauda at 1401 Foxtail Lane, Prince Frederick, MD 20678, USA. You can also phone him (410)260-8615 or send him E-mail at rklauda@dnr.state.md.us. Dr. Klauda can also send copies of his recent (1991) paper on American shad and hickory shad to anyone interested.

New Members

Thank you to our new members this Fall: **Dilip Mathur**, senior fisheries scientist of Normandeau Associates in Pennsylvania; **Dennis Reynolds**, New York/New Jersey Baykeeper in New Jersey; **Christine Moffitt**, Professor in the Department of Fish and Wildlife at the University of Idaho; **Joseph Zydlewski** of the Conte Anadromous Fish Research Center in Massachusetts; **Joseph Hightower** of the North Carolina Cooperative Fish and Wildlife Research Unit at North Carolina State University; **Joseph Zaientz**, proprietor of the Haddam Shad Museum in Connecticut; **Bill Goldsborough**, senior scientist at the Chesapeake Bay Foundation in Maryland; and **Robert Ross**, ecologist with the U. S. Geological Survey in Pennsylvania. Welcome to the Shad Foundation!

INSIDE

SHAD FORUM

The "Shad Forum" department of the Shad Journal publishes letters and comments on issues surrounding shad and their fisheries. Your contributions are welcome.

From Dr. Hussain in Iraq:

Thank you very much for the issues of the *Shad Journal* and it is of great help to us. I have been inspired by your article on the Pacific shad invasion [see "Oceanography of the Pacific Shad Invasion," by Curtis C. Ebbesmeyer and Richard A. Hinrichsen; SHAD JOURNAL, February 1997] to write about the invasion of *Tenualosa ilisha* to a new estuary at the Northwestern Arabian Gulf [Persian Gulf]. Two species of shad have existed in our waters: *T. ilisha* and *Hilsa kelee*. The latter is the least known species and we found great difficulties in finding any literature concerning it. Your help in this matter is highly appreciated.

I am ready to help in any matter concerning Hilsa shad or any related species.

My deep thanks for announcing me as a member of the Shad Foundation.

My Best Regards,

N.A. HUSSAIN
UNIVERSITY OF BASRAH
MARINE SCIENCE CENTRE
BASRAH, IRAQ

Dr. Hussain's article follows.

Hilsa Shad Invade Estuary in the Arabian Gulf

Tenualosa ilisha is known to ascend the Shatt Al-Arab River at the most Northwest tip of the Arabian Gulf [Persian Gulf]. They start their spawning migration in March and continue until July.

During 1983, the lower reaches of the Tigris and Euphrates rivers were connected with the Gulf at Khor Al-Zubair lagoon by a channel, changing the environment from hypersaline to oligohaline. The Khor became an estuarine lagoon, where the salinity dropped to less than 10 parts per thousand. Previously, it was higher than 40 parts per thousand. Consequently, the surrounding mud flats became salt marshes, after the heavy growth of reeds.

MIZANUR RAHMAN

TENUALOSA ILISHA invaded the Khor Al-Zubair lagoon, an estuary in the Arabian [Persian] Gulf, after a channel was constructed that connected the lagoon to the Tigris and Euphrates rivers.

In 1994, fishermen collected hilsa shad from the Khor Al-Zubair lagoon in good numbers in comparison with previous years, followed by a notable decrease during 1995. During the years 1996 and 1997, a big increase was observed, especially in 1997. The numbers collected jumped considerably and exceeded that caught from the original river (Shatt Al-Arab).

The hilsa shad cover the whole lagoon and even the connecting channel (70 kilometer line length and 1-0.4 kilometers in width).

This phenomenon has not previously been observed in the Gulf and somehow resembles the Pacific shad invasion of the western coast of North America.

New Shad Museum In Connecticut

I am writing to you about my involvement with shad. I hope the Shad Foundation is successful and I realize that people like myself, who have a vested interest in shad, must contribute, or it won't last very long.

A little background on myself. I am a retired dentist, 59, mildly handicapped from an old motorcycle accident. Two broken legs, a broken arm, a severe head injury, eight months in the hospital; fortunately, all I have to show for it is a limp and bad balance. I have been using a drift net for shad for more than 20 years usually making only one drift per night so that my dental patients don't suffer from my lack of sleep the next day. My expertise is minimal but my love for the river and doing things outdoors is great. I am also a history buff and wish to preserve a portion of my town's history.

I bought the property on which my dental office was situated about 12 years ago. On the site sat an old shad shack, once owned by Bill Maynard. Bill had many business ventures, and among them was

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Board of Editors: John Waldman, Greg Garman, Curtis Ebbesmeyer, Catherine Hinrichsen, Jim Norris, Joseph Smith, Miran Aprahamian, Charles Paulsen.

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THE SHAD FOUNDATION
P.O. Box 21748
Seattle, WA 98111-3748

The Shad Foundation is a Washington State nonprofit corporation that was established in 1996 to promote a greater understanding of shad for the purpose of restoration where depleted, or their responsible use where sufficiently abundant.

Trustees: Richard A. Hinrichsen, *Hinrichsen Consulting, Seattle, Washington;* Curtis Ebbesmeyer, *Evans-Hamilton, Inc., Seattle, Washington*; Richard St. Pierre, *U.S. Fish & Wildlife Service, Harrisburg, Pennsylvania.*

Submissions. The editors welcome submission of articles on any aspect of shad. The Journal publishes letters, commentaries, histories, scientific articles, interviews, reviews, and philosophical and methodological items related to shad the world over. (See instructions on back cover of previous issues.)

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catching shad and selling them out of a fishing shack along the main street of Haddam. I restored the shad shack, and am making it into a museum to preserve the history of shad fishing in Connecticut.

The building was built in the 1930s next to Maynard's home, about a mile from the river. Bill invested every dollar he made from shad into land at a time when land was inexpensive. There is still much property in his family purchased from funds earned from shad fishing.

Displayed alongside the museum is a Brockway Scow, a shad boat made by Earl Brockway of Old Saybrook, Connecticut. He handmade hundreds of these inexpensive boats—16-foot and 20-foot models—very stable for carrying men, nets, and fish. The boat that I have is a 20-footer that I got from a local tackle shop for $50. The Brockway Scow is square-ended, flat-bottomed, and narrow-beamed enough to be rowable. Oars are used when drifting downriver to keep the proper set in the net. Fishermen would put large outboard motors on them, which distressed Earl because they weren't designed for them.

Earl died last year, and, sadly, the tradition is gone. A local organization gave a lecture about Earl Brockway and his boats, which included blueprints.

Also on display at the museum are boning knives, shad darts for rod and reel fishing, magazine articles featuring shad fishing on the Connecticut River, and pictures of local fishermen on the river. We have four videotaped interviews of older shad fishermen. We have a great tape on shad fishing distributed by the Connecticut River Museum and one by Northeast Utilities about the shad fish lifts at two of the hydroelectric dams on the Connecticut. One of my favorite exhibits is a 4- by 8-foot map of our reach of the Connecticut, which shows who fished, as well as where, when, and how.

My curator is George Bernard, a fellow who lives his life through shad. He is a rod and reel fisherman with great knowledge and inquisitiveness, and he collects artifacts for the museum.

We are also promoting interest in shad for commercial and recreational needs. When I first came to town 25 years ago, boats waited in turn in their various river reaches to make their drift because there were so many fishermen. This year there were only 27 licenses sold for commercial shad netting. Younger people do not fish because part-time work is more available than a generation ago. The season is short, work is hard, and expenses for nets, boats, motors, and a license are high. The price that a fisherman gets for his fish hasn't changed that much and fewer people know how to bone shad.

During the shad season, my boat is alone on the Higganum Reach except for power boats that have ripped my nets two years in a row.

Consumption of shad has two things against it. First, shad are bony, and most are afraid of bones or aren't willing to take time to eat around them. Shad boning was developed into a fine art on the East Coast, but since the work is seasonal and labor-intensive, shad boning is dying out. I am hoping this spring to make an instructional video on boning to preserve the tradition and to export this skill to the West Coast.

Second, shad is an oily fish, and it must therefore be properly prepared. There are many recipes that make this fish taste second to none. One way is planking shad—cooking it slowly, nailed to a board reflecting against a wood fire, so that the oil runs down and is eliminated. Another terrific way is smoking shad. This technique is very popular in Connecticut. Properly prepared, the shad roe is excellent and a truly gourmet entree.

Drift nets are the only legal way of commercially catching shad on the Connecticut. Early in the century there were fixed nets set along the river. When this type of fishing became too hard on the fish populations it was abolished. Then haul seining began. One end of the seine was fixed on shore and the other was pulled out with a boat. The boat circled back into shore and the net was hauled in with a winch or many men. This technique was very successful and when catches decreased, the State of Connecticut abolished haul seining, allowing only drift netting.

Recently, the annual shad population has not been a constant. Last year the run was not bad but some prior years have been very poor. The State of Connecticut has not had much of a program for maintaining shad populations recently because a great deal of money has gone into restoring Atlantic salmon population to the Connecticut River. This has not been successful at all, and I would like to see money going back into shad management.

Shad season is a very popular time in Connecticut. There are shad derbies for the rod and reel fishermen, and many towns and organizations have festivals featuring shad bakes. The shad has contributed much recreation and history as well as food and commerce to the Connecticut River and people of Connecticut.

During the shad season, my boat is alone on the Higganum Reach except for power boats that have ripped my nets two years in a row, until I got a power megaphone with a light and a fire siren.

Anyone interested in helping me with the museum, my knowledge of shad, or in seeing the museum should get in touch.

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Quaker Neck Dam Removal

On Dec. 17, 1997, Carolina Power and Light (CP&L) officials and invited federal officials held a ceremony to celebrate the voluntary demolition of CP&L's Quaker Neck Dam on the Neuse River. Dam removal will allow anadromous fish (e.g., striped bass, American shad) to use an additional 75 miles of historical spawning habitat in the Neuse River and 925 miles of tributary spawning areas. This project is a joint effort initiated by the Coastal America partnership of federal, state, and local agencies, and non-governmental organizations. [CP&L press release, National Oceanic and Atmospheric Administration press release]

Virginia Shad Moratorium

The Virginia Marine Resources Commission voted 5-1 on December 16, 1997 to continue a four-year moratorium on commercial fishing for shad, based on the limited knowledge of the health of this resource. [Associated Press]

Shad In Iranian Waters

Iran is home to a cosmopolitan group of shad species that is commercially important to a population which has more than tripled in the last 20 years

by Brian Coad

Iran is the second largest country in Southwest Asia—with an area of 1,648,000 square kilometers—and ranks 14th in the world in size, nearly as large as the British Isles, France, Italy and Spain combined. Much of it is classified as desert or semi-desert and its significant, non-marine commercial fisheries are limited to certain marshes and large rivers in the southwest and the brackish Caspian Sea and its rivers.

The population of Iran has doubled in the past 20 years to about 70 million people and the government is investing in the development of fisheries to enhance protein resources. The following account is a general review of the shad species found in Iranian fresh and brackish waters, their biology and their fisheries.

Systematics

The shads of Iran comprise nine species: five from the genus *Alosa*, three from the *Clupeonella*, and one from *Tenualosa*:

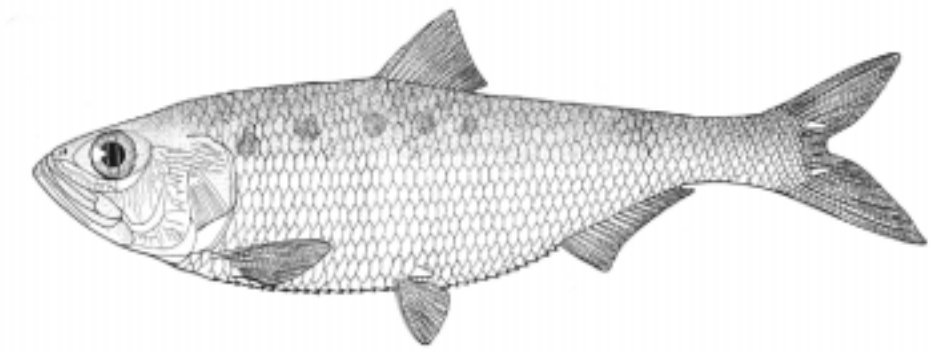
Alosa brashnikovi (Borodin, 1904)
Alosa caspia (Eichwald, 1838)
Alosa pontica (Eichwald, 1838)
Alosa saposhnikovi (Grimm, 1887)
Alosa sphaerocephala (Berg, 1913)
Clupeonella cultriventris (Nordmann, 1840)
Clupeonella engrauliformis (Borodin, 1904)
Clupeonella grimmi (Kessler, 1877)
Tenualosa ilisha (Hamilton-Buchanan, 1822)

The *Alosa* and *Clupeonella* species are found in the Caspian Sea, adjacent lagoons and tributary rivers. *T. ilisha* is found in rivers draining to the Persian Gulf, particularly the large rivers at its head. The *Alosa* species were formerly placed in the genus *Caspialosa*. The general Farsi name for *Alosa* species is "*shag mahi*"; for *Clupeonella* species, "*kilka*"; and for *Tenualosa*, "*sobour.*"

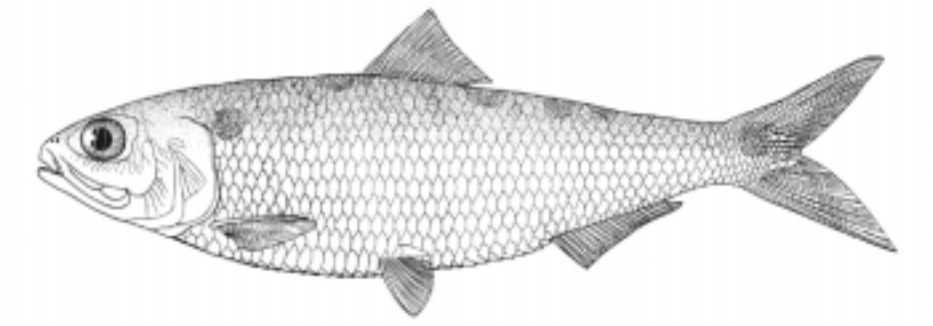
An indication of the systematic problems associated with these shads is found in the species *Alosa brashnikovi* which is recorded as having nine subspecies, an indication of its large populational variation. Not all subspecies may be valid and a modern revision is required to assess this problem. Some of the variation may be related to trophic factors rather than species distinction.

The subspecies *grimmi* is specialized in its benthic mode of life, feeding mostly on gobies (Gobiidae). It has a unique well-developed callus on the tip of its lower jaw which adults acquire from rubbing the jaw on the sea bed while feeding. It has few gill rakers because it does not eat fine food, and the tips are broken off, broadened, and split owing to abrasion. The rakers on the lower arch are reduced in number so the first raker is far from the tongue base.

In contrast, the subspecies *kisselevitshi* has many gill rakers. These are pointed and not split at the tips, and the first raker is close to the tongue base. This subspecies lives in surface waters feeding on *Clupe-*



Alosa brashnikovi



Alosa caspia

onella, the silverside *Atherina boyeri*, and shrimps.

Alosa species are much larger than sympatric *Clupeonella* species, reaching 75 centimeters in length compared to 20 centimeters. They are distinguished by a large mouth, a black spot on the flank behind the operculum (sometimes a row of such spots), an elongated scale or ala at the upper and lower base of the caudal fin, a notch at the mid-line of the upper jaw and by the last two anal fin rays not being elongated. All Iranian fresh and brackish water shads can be identified with the aid of the key below.

Alosa species are generally dark on the back and top of the head with blue, violet or greenish tints, although some may be quite pale with a grey or grass-green back. There is often a spot on the flank behind the head and some individuals may have up to 13 spots in a row. Fins may be dark or light, varying individually or with the species and subspecies. The flanks and belly are silvery.

Clupeonella species have a dark blue, blue-green or light green back, silvery flanks and a silvery or silvery-white belly. Fins are mostly hyaline (transparent or nearly so) although the dorsal fin may have a central dark stripe and the caudal fin a dark base.

T. ilisha has a grey-blue to green back with silvery flanks bearing golden or purplish highlights. Paired fins are hyaline. The dorsal fin is grey, the caudal fin grey-blue with a silvery tinge and a darkened margin and the anal fin is light blue with some silvery tinges. There is a dark blotch behind the head on the flank in young and in many adult fish, followed by a series of six to seven spots or blotches. The eye is yellow to red.

Key For Identifying Shad in Iranian Waters

1. Upper jaw without a median notch, rounded when viewed from in front. Last two anal fin rays enlarged. Lower jaw articulation with skull below or anterior to posterior eye margin. Caspian Sea species . . . . . **go to 2**

Upper jaw with a median notch. Last two anal fin rays not enlarged. Lower jaw articulation with skull behind posterior eye margin: . . . . . **go to 4**

2. Pectoral fins pointed at tips. Head short and wide (interorbital width 16 percent or more of head length) . . . . . **go to 3**

Pectoral fins rounded at tips. Head large and narrow (interorbital width 15.5 percent or less of head length) . . . . . *Clupeonella grimmi*

3. Body and belly compressed (body depth about 21-27 percent of standard length). Keeled belly scales evident . . . . . *Clupeonella cultriventris*

Body cylindrical and belly rounded (body depth 16-19 percent of standard length). Keeled belly scales weakly developed. . . . . *Clupeonella engrauliformis*

4. Branched pelvic fin rays 8. Upper gill rakers overlap lower gill rakers at angle of first arch. Caspian Sea species . . . . . **go to 5**

Branched pelvic fin rays 7. Upper gill rakers not overlapping lower gill rakers at angle of first arch. Entering rivers of southern Iran . . . . . *Tenualosa ilisha*

5. Body deep and compressed. Head large and deep, wedge-shaped in anterior view. Caudal peduncle short. Pectoral fins long . . . . . **go to 6**

Body not deep and not compressed. Head not large and deep, not wedge-shaped in anterior view. Caudal peduncle not short. Pectoral fins short . . . . . **go to 8**

6. Gill rakers on first arch 60 or more, thin and long, much longer than gill filaments. Teeth weakly developed . . . . . *Alosa caspia*

Gill rakers on first arch 45 or less, shorter, equal to or somewhat longer than gill filaments. Teeth well developed . . . . . **go to 7**

7. Upper and lower profiles of head straight. Lower jaw protruding and its upper edge straight. . . . . *Alosa saposhnikovi*

Upper and lower profiles of head rounded. Jaws equal in length and lower jaw has a crescentic upper edge . . . . . *Alosa sphaerocephala*

8. Gill rakers 47 or less, thick and coarse. . . . . *Alosa brashnikovi*

Gill rakers 59 or more, may be thin and long but can be coarse and short . . *Alosa pontica*

Biology

Curiously, the species and subspecies in the Caspian Sea basin are generally larger than their relatives in the Black Sea basin. This is attributed to the variable environment in the Caspian Sea over time, with repeated changes in salinity and temperature which larger and more mobile fish could avoid. Black, Mediterranean and Atlantic species live under more stable conditions and could, in any case, retreat from lowered temperatures for example.

In addition, the Caspian Sea clupeids have fewer competitors, and so *Clupeonella* species and *Alosa caspia* occupy the pelagic, planktivore niche—a niche in the Black Sea which is largely filled by competing species that entered from the Mediterranean and the Atlantic. In the Caspian, there are no competing pelagic fish besides herrings in the stable salinity areas.

Alosa species are generally larger than *Clupeonella* species, as noted above, although *A. sphaerocephala* reaches only 25 centimeters. The heaviest *Alosa*, *A. pontica*, averages about 2 kilograms, while the other species weigh 300 grams or less on average. Adult *T. ilisha* exceed 60 centimeters, and weigh about 2.5 kilograms.

Distribution and Habitat

Alosa brashnikovi, *A. saposhnikovi*, *A. sphaerocephala*, *Clupeonella engrauliformis* and *C. grimmi* are endemic to the Caspian Sea, while *A. caspia*, *A. pontica* and *C. cultriventris* are found in the Caspian and Black seas.

T. ilisha is found in rivers at the head of the Persian Gulf including the Dez, Bahmanshir, Jarrahi, Zohreh and Hilleh rivers in Iran. At sea, it is found from Bushehr in Iran around to Kuwait in coastal waters and east through the Indian subcontinent to

Myanmar.

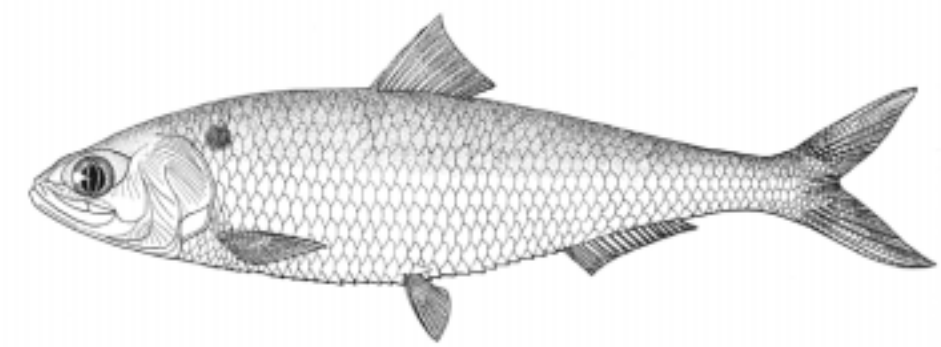
Alosa species are widely distributed in the Caspian Sea, chiefly in the warmer and deeper waters of the south in winter, moving to northern waters in the spring to spawn and feed. Some species and subspecies enter rivers to spawn, for example, *A. pontica* enters the Volga River of Russia and *A. caspia persica* enters the Anzali Lagoon of Iran; others, *A. sphaerocephala*, for example, spend all their lives in open waters. Certain subspecies have more restricted distributions and movements, spending their entire lives in the southern Caspian in and near Iranian waters.

Vertical migrations occur seasonally, into deeper and warmer waters in winter, as well as following prey. Maximum depth is about 300-450 meters for both *Alosa* and *Clupeonella* species.

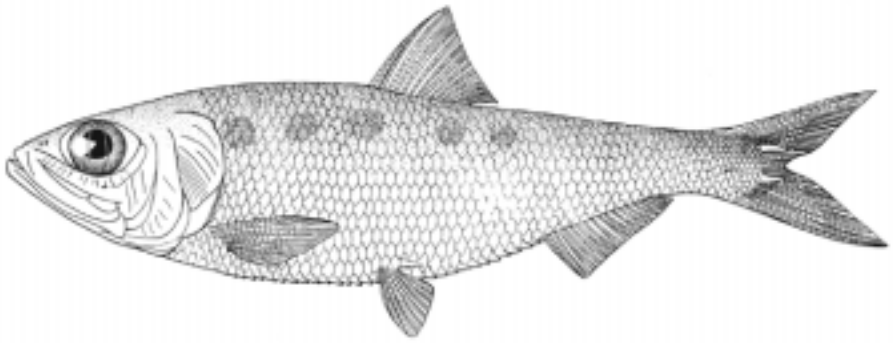
C. cultriventris is found in both the Caspian Sea and in tributary rivers and some adjacent lakes while the other two *Clupeonella* species are concentrated in the central and southern Caspian Sea away from the coasts. *Clupeonella* species are found over a wide range of temperatures from under ice to over 28 degrees Celsius and from fresh to hypersaline waters. They migrate northward to spawn in spring with a return south in autumn.

Large schools are found at varying depths in response to temperature fluctuations. For example, *C. cultriventris* 0.5-2.0 kilometers offshore on the eastern Caspian coast are about 20-25 meters deep in spring and summer. They rise to 8 meters as temperatures drop in autumn and, in the winter, they descend to 30-40 meters where water is 7-10 degrees Celsius warmer than surface waters. *C. grimmi* forms large schools found at depths near 130 meters.

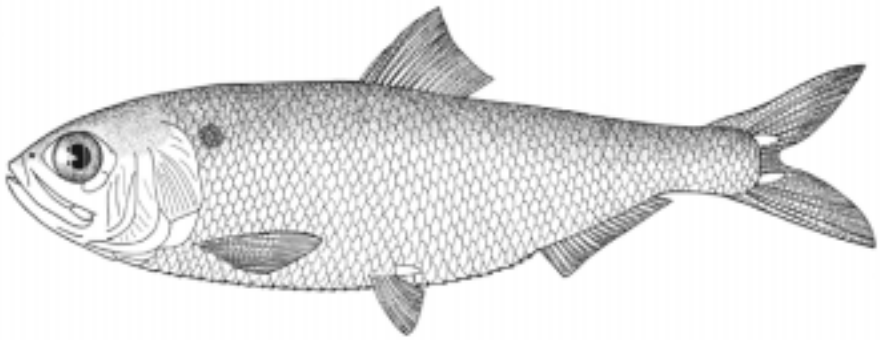
T. ilisha is found in both deep (18 meters) and shallow waters on the spawning migration while the young are found in the shallow waters of side branches of the main rivers. Large concentrations of adults are found below dams which block the spawning migration.



Alosa pontica



Alosa saposhnikovi



Alosa sphaerocephala

Age and Growth

Life span of *Alosa* species is up to 10 years with maturity at 2-5 years, varying with the species, subspecies, stocks and year-class strengths. In *A. caspia*, first spawners in one study constituted 75.9 percent of the 3-year-olds, 41.7 percent of the 4-year-olds and 23.5 percent of the 5-year-olds. Most south Caspian forms of *A. brashnikovi* mature at age 2 and length and weight is less in southern waters than in northern waters. Spawning in *Alosa* species may occur up to four times as sexual maturation continues for 2-5 years although many fish die after spawning and some skip a year before spawning again. Early maturers, as in the south Caspian populations, may spawn seven times. Generally female lengths and weights exceed those of males throughout life.

Life span of *Clupeonella* species is up to eight years with maturity at 1-2 years. Fishes aged 2-4 years dominate catches. Populational and yearly differences in growth are common depending on variations in productivity. Southern populations grow faster than northern ones and females faster than males. *C. cultriventris*, together with the sturgeons, comprises 82.1 percent of the fish biomass in the Caspian Sea.

In the Bahmanshir River of Iran most *T. ilisha* are 4-5 years old with a minimum total length, weight and age at maturity of 26.2 centimeters, 200 grams and 2 years for males and 32.2 centimeters, 450 grams and 3 years for females.

Food and Predators

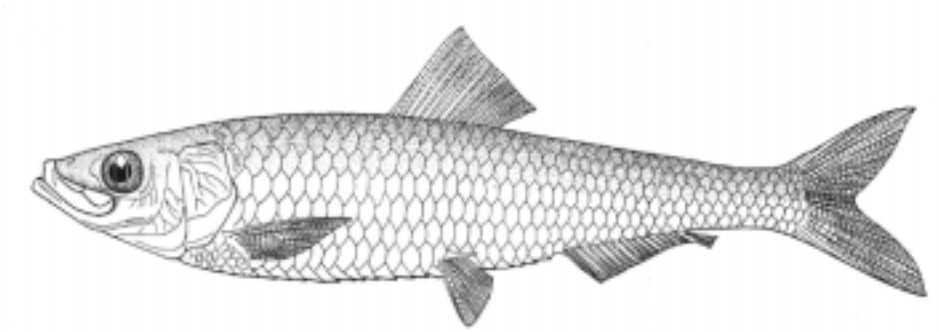
Alosa species feed on other fishes including *Clupeonella engrauliformis*, *C. cultriventris*, the silverside *Atherina boyeri*, gobies (*Neogobius* species),

shrimps, copepods, mysids and other large crustaceans, zooplankton, and some molluscs. The larger *Alosa* are also cannibals. There are dietary variations between individual species and subspecies and between seasons. The diet of *A. caspia*, for example, is 70 percent copepods and 20 percent mysids with some small fishes. The winter diet of *A. brashnikovi* in the southeastern Caspian is 85 percent *Clupeonella engrauliformis* while in summer it is dominated by *C. cultriventris*. The Caspian seal, *Pusa caspica*, is preys on *Alosa* species in the sea and the catfish *Silurus glanis* preys on *Alosa caspia*, which enters fresh water in Iran.

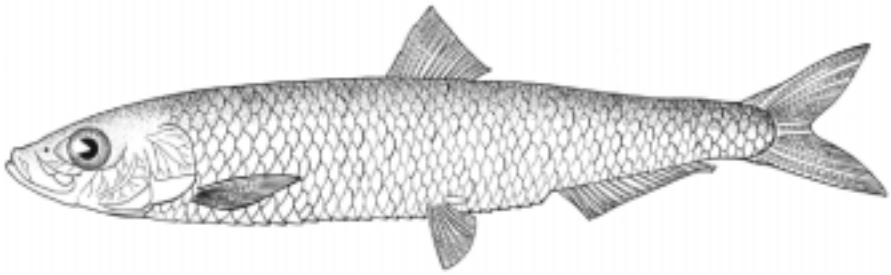
Fecundity of T. Ilisha may reach 1,616,560 eggs for fish 33.0 to 41.5 centimeters long.

Clupeonella species take mostly zooplankton, especially copepods but also mysids, fish fry, cladocerans, and *Balanus* and clam larvae. The vertical and seasonal migrations of *C. engrauliformis* mirror that of its principal food item, the copepod *Eurytemora grimmi*, which can comprise over 70 percent of its diet. The three *Clupeonella* species share the available habitat and its foods, *cultriventris* in shallow coastal waters, *engrauliformis* in the upper layers of the open sea and *grimmi* in deeper waters of the open sea. *Clupeonella* species are important foods for the Caspian seal, sturgeons (as much as 60 percent of their diet), *Alosa* species, pikeperches (*Stizostedion* species), Caspian salmon (*Salmo trutta caspius*) and inconnu (*Stenodus leucichthys*). Predators consume 590 million kilograms of kilkas each year making these fish a very important element in the life of the Caspian Sea.

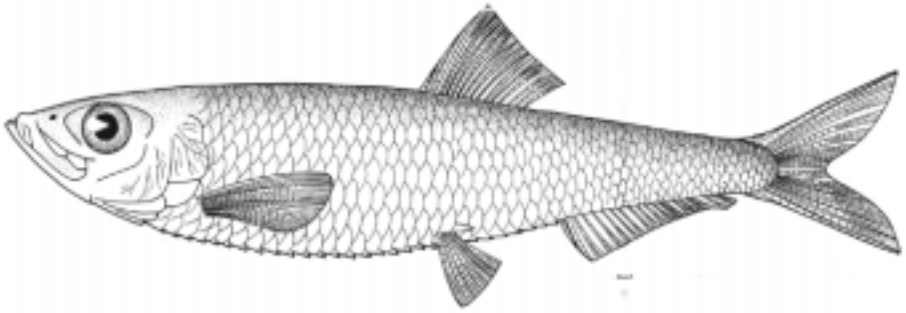
The food of juvenile *T. ilisha* is phytoplankton and zooplankton, principally diatoms and copepods in Iran. Adults have empty stomachs on the spawning run.



Clupeonella cultriventris



Clupeonella engrauliformis



Clupeonella grimmi

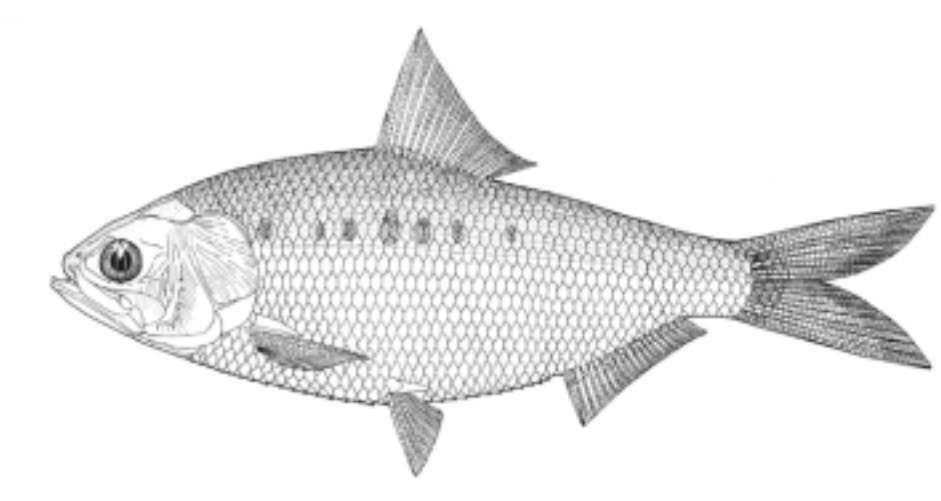
Reproduction

The time, place, temperature and fecundity of spawning *Alosa* vary with the species and subspecies. Timing may be as early as April or as late as August with temperatures as low as 11 degrees Celsius or as high as 27 degrees Celsius. Fecundity is 41,000 to 312,000 eggs for river spawners and 20,000 to 178,400 eggs for sea spawners. Spawning takes place in shallow water (less than 8 meters deep) in the sea over sand and silt bottoms or in river mouths, rivers and coastal lagoons. Eggs are pelagic and develop as they drift in the sea or river, taking 40 hours at 23 degrees Celsius in *A. pontica*, for example. There is no feeding while spawning.

Spawning in *Clupeonella cultriventris* is as early as January-February in the southern Caspian in shallow waters less than 10 meters deep. Temperatures are 10-20 degrees Celsius. Fecundity is 60,000 eggs and relative fecundity is 4-13 times greater than for *Alosa* species. Spawning in *C. engrauliformis* occurs from late April to November, most intensively in July at 13-24 degrees Celsius, in both coastal areas and the open sea at 50-200 meters depths. Fecundity is 39,900 eggs. In *C.*

grimmi spawning is extended, from January through September but is most intensive in spring and autumn. Depths are 10-25 meters and temperatures 6-13 degrees Celsius. Fecundity is 28,300 eggs.

The spawning migration of *T. ilisha* begins as early as February with a peak at the end of March and beginning of April. Fry first appear at the end of June. There is a return migration to the Persian Gulf after spawning. Fecundity of *T. ilisha* may reach 1,616,560 eggs for fish 33.0-41.5 centimeters long.



Tenualosa ilisha

Conservation

The Caspian Sea has numerous problems associated with pollution, fluctuation in water levels and illegal fishing, much of them outside Iranian control. The increase in commercial fisheries for shads will necessarily affect the numbers of spawning individuals and certain stocks adapted to specific areas of the southern Caspian may become depleted. The intensive fishing will require careful management.

Gill net catches of *A. caspia* dominated the Soviet commercial catch in the Caspian in the 1960s but were banned because young of more valuable commercial species were being killed. Light-assisted catches of *Clupeonella* species damage stocks of young *Alosa* species which are an incidental catch.

There are reports of declines in catches of *T. ilisha* in the Shatt al-Arab of Iraq, a river shared with Iran. The effects of the Iran-Iraq war are unknown although perversely it may have helped stocks by restricting fisheries in the disputed waterway.

Fishery

The catch for all *Alosa* species in Iranian waters has been as high as 700 tons while the catch for *A. brashnikovi* alone for the Caspian Sea as a whole (i.e., former Soviet catches) has reached 12,690 tons. *A. caspia* has been caught in Iranian waters but only in small amounts since it is regarded as inferior. Soviet catches have reached 75,000 tons. *A. pontica* catches reached 69,100 tons in Soviet waters, and *A. saposhnikovi*, 8,800 tons, but there seems to have been no Iranian fishery. *A. sphaerocephala* has only been caught in small numbers.

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The *kilka* or *Clupeonella* catch in the Iranian Caspian Sea reached 51,000 tons in 1994 from none 10 years previously. A ceiling of 100,000 tons has been suggested from a resource of 800,000 tons. The catch is taken by the Industrial Fishing Company and fishing cooperatives using artificial lights as attractants, deep conical nets, and air lifting.

Catch rates of *kilka* on the top ranking 17 fishing grounds (of 56 studied) range from 1 to 1.5 tons per unit effort per hour while traditional grounds have rates of 0.5-1 tons per unit effort per hour. The *kilka* fishing fleet of Iran expanded in the 1980s and 1990s. There were 30 active vessels in Mazandaran Province in 1994, each with a capacity up to 30 tons. Gilan Province planned to construct 12 fish meal factories each with an annual capacity of 1,000 tons and 10 *kilka* canneries also with 1,000-ton capacities.

A small portion of the catch is used in a high value form as frozen whole consumer packs, smoked, salted and canned in sauce and the rest is used as fish meal for poultry and in aquaculture. *C. cultriventris* comprises only 1.35 percent and *C. grimmi* only 6.84 percent of the Iranian catch of kilkas which is dominated by *C. engrauliformis* at 91.8 percent. This is attributed to the larger spawning and foraging range of the latter species.

T. ilisha catches in southern Iran have been as high as 401 tons with similar catches at Basrah in Iraq. The fish are caught with traps, weirs, and gill nets on the spawning migration. They appear on local fish markets in Iran as early as April and as late as September.

The Author

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Further Reading

A "Bibliography on the Freshwater Fishes of Iran" is available at http://gause.biology.ualberta.ca/Keivany/irbiblcoad.html. Relevant references include Borodin and Suvorov (1908), Emadi (1991), Hoestlandt (1991), Parafkandeh Haghigi (1996), Marammazi (1995), Prikhod'ko (1981), Razavi Sayad (1993) and Svetovidov (1952), among others.