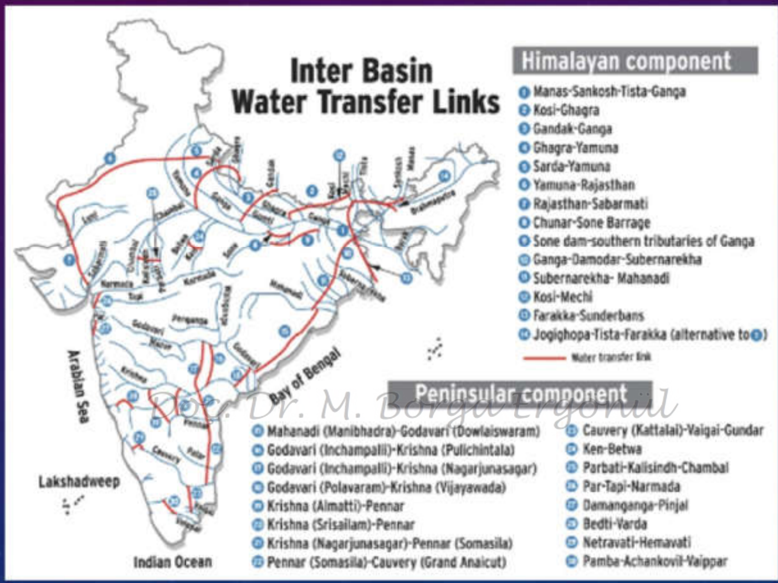
Hydrobiology -5

Irrigation channels; one of the most important effects is related to enormous water consumption for agricultural purposes. Since lots of water is diverted from the main river channel they lead to a decrease in natural flow regime. Furthermore, they also create interconnections between rivers which are not naturally connected; thus, removing barriers and leading to dispersal of any invasive species between basins. Such irrigation canals are home to many invasive macrophyte and fish species.

Interlinking or interconnection of rivers by construction of large canals is also carried out in some countries including India. Although there are several advantages of this interlinking project there are also some disadvantages.



Advantages:
Preventing drough-flood events
Continuous supply of water for irrigation and drinking
Navigation canals

Disadvantages:
Deforestation of large areas
Loss of land particularly deltas in river mouths
Alteration of biological composition (both terrestrial and aquatic); invasive species threat
Alteration of fish migration
Alteration of spawning grounds

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REVIEWS

River inter linking in India: status, issues, prospects and implications on aquatic ecosystems and freshwater fish diversity

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Abstract India is a vast country in terms of natural resources and considered one of the mega- biodiversity countries in the world. The freshwater aquatic resources of the different river basins are unevenly distributed in space and time and the country is suffering from the increasing population and shortage of all kind of natural resources like water. To fulfill the water demand and mitigate flood and drought, Indian Government has been planning a huge scheme encompassing the Himalayas and most of India, by linking all major rivers through interlinking canals systems and building several dams. Though the concept of interlinking of rivers is novel and new in India, it had rather initiated long back in other countries of ancient civilization. This is considered as one of the options to remedy spatial mismatch in water availability and demand. To overcome those, National Water Development Agency (NWDA) has been signed among the states of Uttar Pradesh and Madhya Pradesh and the Union Government. The feasibility report of most of the links have been completed and detailed project reports of Ken-Betwa River link is expected to be finalized soon. Our study indicated presence of rich fish diversity and threatened fishes in river Betwa and improved aquatic environment in river Ken which makes it a high priority area in view of proposed interlinking. The current state of knowledge indicates that large dams, interbasin transfers and water withdrawal from rivers have many negative as well as positive impacts on freshwater aquatic ecosystem. As regards to the impact on fish and aquatic biodiversity, there could be positive as well as negative impacts. The present paper is aimed at explaining and synthesizing the long term plan and its implications, creating baseline database, require-

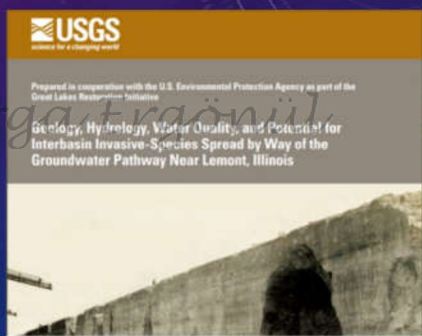
Construction of water canals to transfer water from Hirfanlı Dam Lake to Tuz Lake (~40 km long)

Inter-basin water transfers and the expansion of aquatic invasive species

Running title: Water transfers promote biological invasions

Interbasin Water Transfer, Riverine Connectivity, and Spatial Controls on Fish Biodiversity

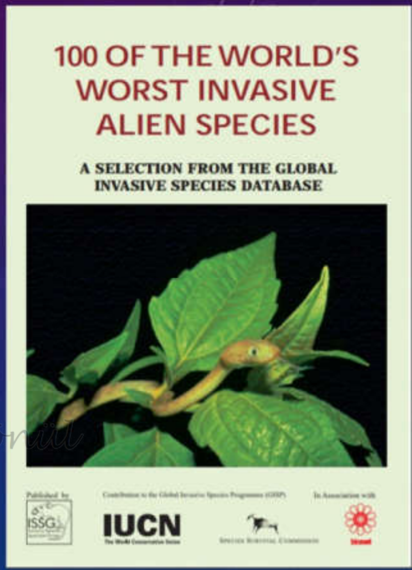
Abstract



A paranthesis here: Invasive species

An invasive species can be any kind of living organism—an amphibian, plant, insect, fish, fungus, or even an organism's seeds or eggs— which is not native to the ecosystem where it is transported either unintentionally or voluntarily. Most of them causes harm to the new habitat and native flora/fauna and even to the economy, or even human health. Invasive species have a great potential to grow rapidly, reproduce quickly, and spread aggressively. Many of them are tolerant to unfavorable conditions. Due to the absence of their natural predators in the new habitat they compete with native species and dominate the fauna/flora.

Invasive species does not need to come from another country, any species which has been translocated to a different basin may also be invasive.



Potential effects of aquatic invasive species

Ecological Effects	Economic Impacts	Public Health Concerns
Predation	Industrial water users	Cholera risk
Parasitism	Nuclear power plants	Paralytic shellfish poisoning
Competition	Other water sports	Harmful algal blooms
Introduction of new pathogens	Damage to dams	
Genetic changes	Fishing	
Habitat alterations		
Species shifts/loss of biodiversity		

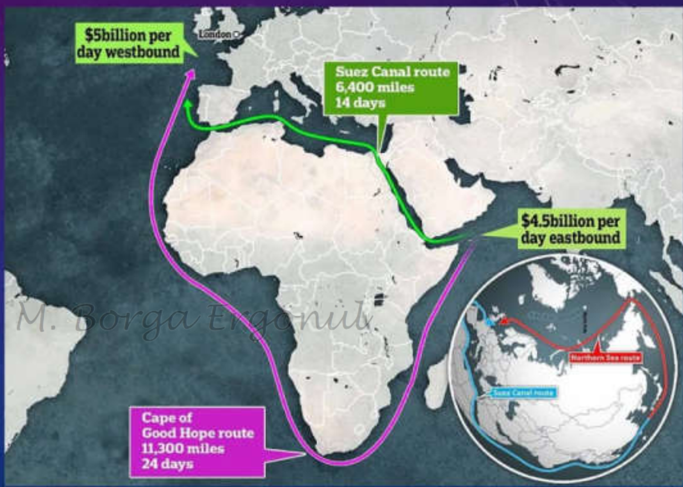
Carassius carassius (Crucian carp)

Eichhornia crassipes (Water hyacinth)

An example: Effects of an invasive species: *Dreissena polymorpha* (Zebra mussel)

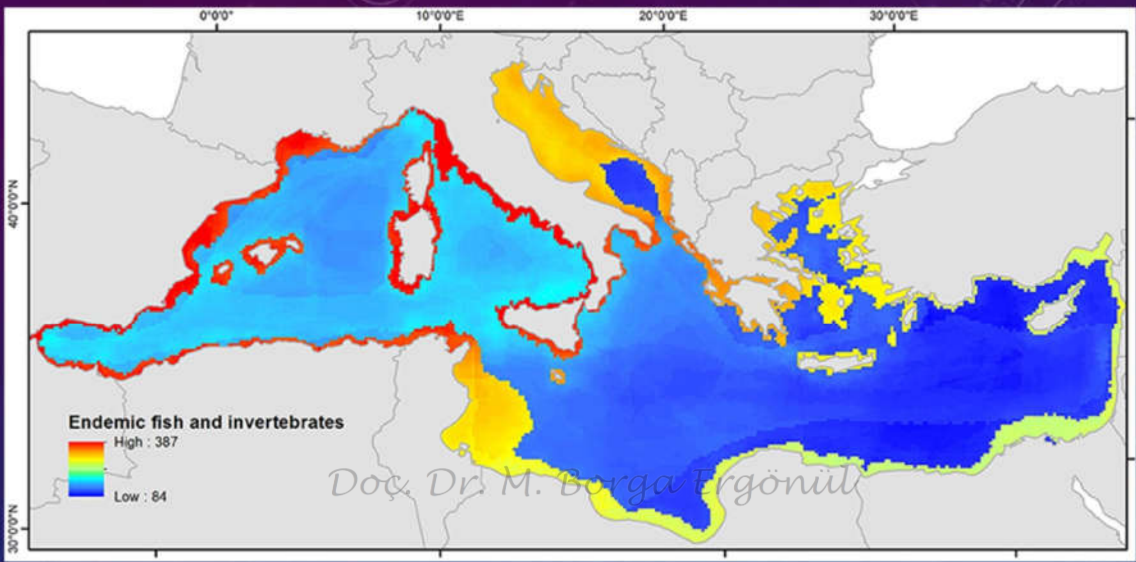
The Suez Canal (1869) is a man-made waterway connecting the Mediterranean Sea to the Indian Ocean via the Red Sea. It enables a shorter route for shipping between Europe and Asia, effectively allowing for passage from the North Atlantic to the Indian Ocean without having to circumnavigate the African continent. The waterway is vital for international trade.

The Suez Canal, which now stretches some 193 kilometres from the Red Sea to the Mediterranean, provides a highway for ships and invasive species alike.



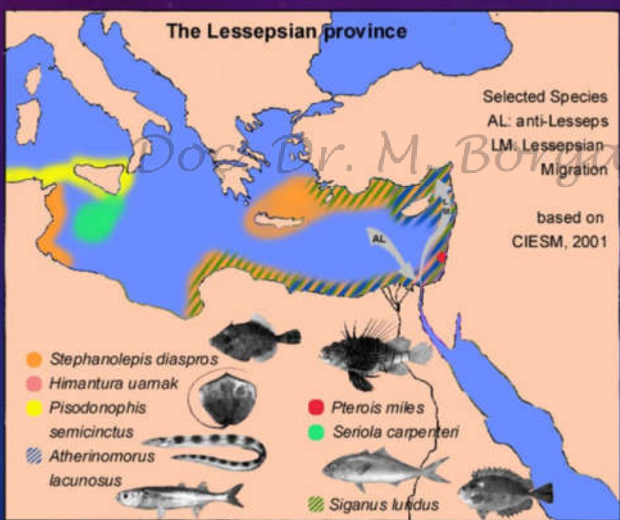
Besides it is benefits to the international trade between countries the channel provides a highway for more than meets the eye. Since its construction (1869), over 400 alien species (in some sources 500) have spread from the Red Sea to the Mediterranean, and are building strongholds in the sea's eastern margins. Some of these species are fundamentally altering Mediterranean ecosystems.

Richness (number of species in a 10 × 10 km grid) of marine alien species introduced in the Mediterranean Sea through the Suez Canal (Lessepsian immigrants).



Richness (number of species in a 10 × 10 km grid) of native fish and invertebrates in the Mediterranean Sea. Indicating the loss of native fauna in Med. Sea after Suez Canal built.

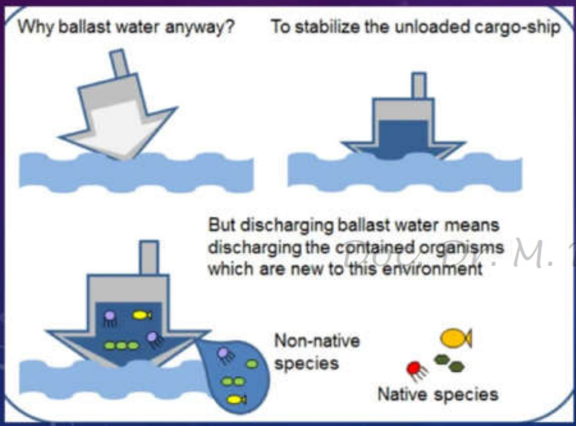
The species migrating from Red Sea to the Mediterrenean Sea are called as Lessepsian immigrants. They are named after Ferdinand de Lesseps, the French engineer for the construciton of the Suez Canal. Sometimes these marine species are also called Lessepsian species. The movement of those species is called Lessepsian immigration

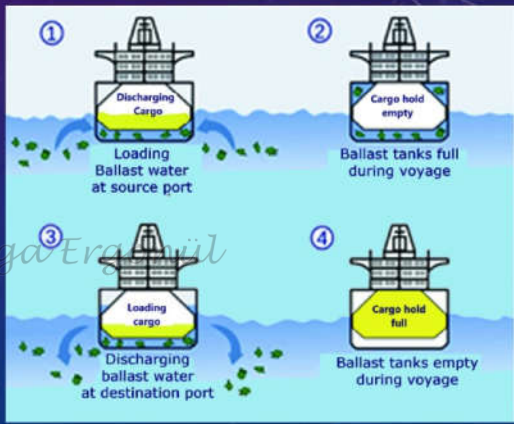


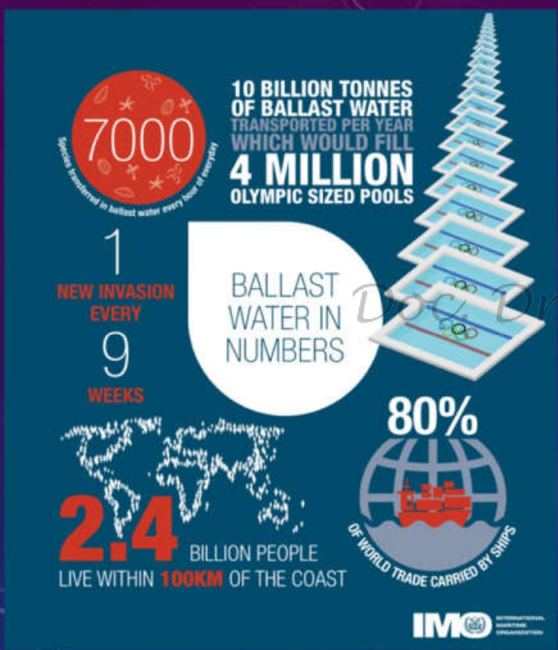
Most of the Lessepsian immigrants are invasive for Meditarranean Sea. Many of them are dangerous for human consumption or their fin rays are poisonous.

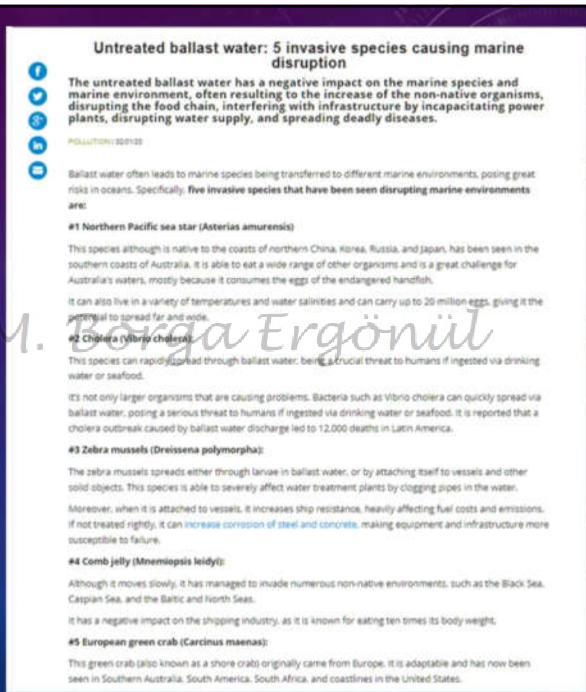



Another interbasin water transfer and related problems arise from the ballast water discharge of ships. Ballast water may be taken onboard by ships for stability and can contain thousands of marine microorganism, plants and animals, which are then carried across the globe. Untreated ballast water released at the ship's destination may potentially introduce a new invasive species. Hundreds of such invasions have already taken place, sometimes with devastating consequences for the local ecosystem.









Untreated ballast water: 5 invasive species causing marine disruption

The untreated ballast water has a negative impact on the marine species and marine environment, often resulting to the increase of the non-native organisms, disrupting the food chain, interfering with infrastructure by incapacitating power plants, disrupting water supply, and spreading deadly diseases.

Ballast water often leads to marine species being transferred to different marine environments, posing great risks in oceans. Specifically, **five invasive species that have been seen disrupting marine environments are:**

#1 Northern Pacific sea star (Asterias amurensis)

This species although is native to the coasts of northern China, Korea, Russia, and Japan, has been seen in the southern coasts of Australia. It is able to eat a wide range of other organisms and is a great challenge for Australia's waters, mostly because it consumes the eggs of the endangered handfish.

It can also live in a variety of temperatures and water salinities and can carry up to 20 million eggs, giving it the potential to spread far and wide.

#2 Cholera (Vibrio cholera):

This species can rapidly spread through ballast water, being a crucial threat to humans if ingested via drinking water or seafood.

It's not only larger organisms that are causing problems. Bacteria such as Vibrio cholera can quickly spread via ballast water, posing a serious threat to humans if ingested via drinking water or seafood. It is reported that a cholera outbreak caused by ballast water discharge led to 12,000 deaths in Latin America.

#3 Zebra mussels (Dreissena polymorpha):

The zebra mussels spreads either through larvae in ballast water, or by attaching itself to vessels and other solid objects. This species is able to severely affect water treatment plants by clogging pipes in the water.

Moreover, when it is attached to vessels, it increases ship resistance, heavily affecting fuel costs and emissions. If not treated rightly, it can increase corrosion of steel and concrete, making equipment and infrastructure more susceptible to failure.

#4 Comb jelly (Mnemiopsis leidyi):

Although it moves slowly, it has managed to invade numerous non-native environments, such as the Black Sea, Caspian Sea, and the Baltic and North Seas.

It has a negative impact on the shipping industry, as it is known for eating ten times its body weight.

#5 European green crab (Carcinus maenas):

This green crab (also known as a shore crab) originally came from Europe. It is adaptable and has now been seen in Southern Australia, South America, South Africa, and coastlines in the United States.


Marine plants, animals and microbes are being carried around the world attached to the hulls of ships and in ships' ballast water.
When discharged into new environments, they may become invaders and seriously disrupt the native ecology and economy.
Introduced pathogens may cause diseases and death in humans.
Doç. Dr. M. Borga Ergönül


Mnemiopsis leidyi
Rapana venosa
Global Ballast Water Management Programme
GLOBALLAST MONOGRAPH SERIES NO.3
1st Black Sea Conference
on Ballast Water Control
and Management
Doç. Dr. M. Borga Ergönül

DO NOT CONFUSE EXOTIC AND INVASIVE SPECIES

EXOTIC SPECIES VERSUS INVASIVE SPECIES

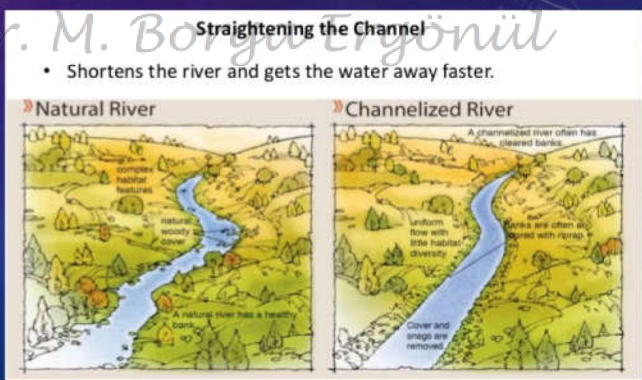
EXOTIC SPECIES	INVASIVE SPECIES
An exotic species refers to a plant, animal or microorganism species which is introduced into an area outside of its native range	An invasive species refers to an exotic species whose introduction causes environmental and economic harm to the ecosystem
Not harmful to ecosystems	Harmful to ecosystems
May require a lot of resources for the growth	Have a fast growth, rapid reproduction ability, and a high dispersal ability
May consist of natural competitors or enemies	Do not consist of natural competitors or enemies
Do not have an effect on native species	May completely replace native species

Exotic—organisms that have been introduced by human activity into an ecosystem where they are not native.

Invasive species—exotic that spreads naturally into natural or semi-natural habitat, causing a major change in the habitat and how it functions

River Channelization

Sometimes natural rivers are also channelized where the river is restricted to the main channel and is disconnected from the surrounding riparian zone. River channelization involves modification, for the purposes of flood control, drainage, navigation, and prevention of erosion. Direct channelization including straightening led to the modification of lowland rivers.



Channelization has many advantages such as making the stream more suitable for navigation by larger vessels. Another is to restrict water to a certain area enabling suounding areas to be used as agricultural areas. It also enables flood control, with a sufficiently large and deep channel. Reduces natural erosion of topsoil which is normaly washed away by flow.

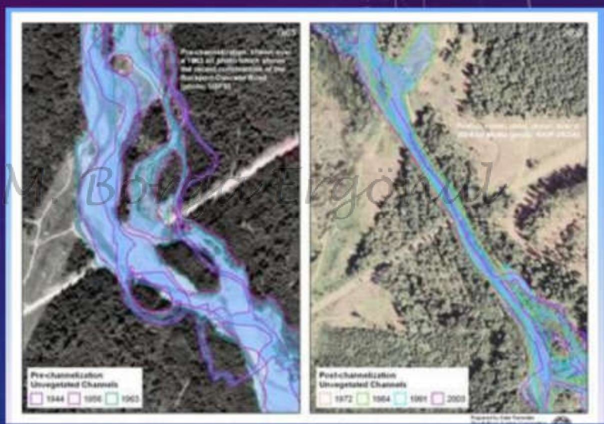
On the other hand it has lots of several disadvantages including loss of wetlands and alteration of riparian vegetation. To straighten a river leads to an increase in flow velocity thus reducing retention time of water in the river bed. Such a situation will alter the biodiversity. In addition, studies have shown that stream channelization results in declines of river fish populations. This loss of fish diversity and abundance is thought to occur because of reduction in habitat, elimination of riffles and pools, greater fluctuation of stream levels and water temperature, and shifting substrates.

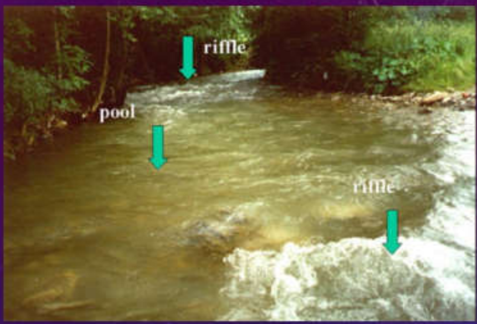
THE IMPACT OF RIVER CHANNELIZATION

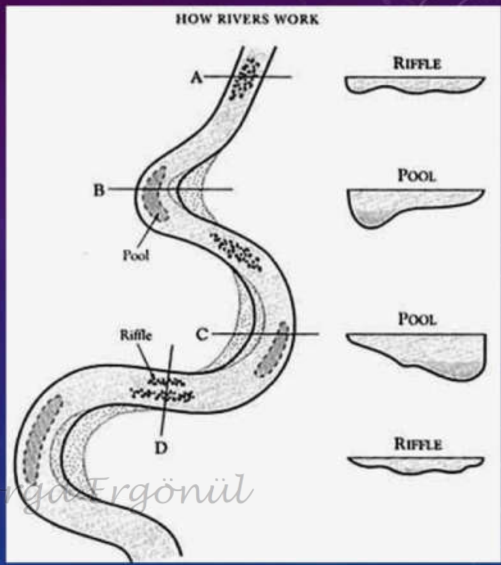
IV THE ECOLOGICAL EFFECTS OF CHANNELIZATION

M. P. BROOKER

CHANNELIZATION IS the group of engineering practices used to control flooding, drain wetlands, improve river channels for navigation, control stream-bank erosion and improve river alignment (Brookes, 1981). In England and Wales the principal needs are related to navigation—usually requiring wider and deeper channels—and land drainage, which is facilitated by an increase in the bed gradient of the channel and a reduction in the retention time of water in the reach, usually achieved by straightening and shortening the channel. Clearly such activities are likely to have major ecological consequences for the aquatic biota in the river channel, and they can also substantially damage those wildlife resources associated with the linear terrestrial habitat. Despite the importance of the wildlife resources of rivers and their environs and the intensity of channelization in the UK (Brookes, 1981), there are few published studies of the ecological effects of channelization, although several workers acknowledge the likely impact of such activities (Haslam, 1973, 1978; George, 1975). Swales (1982a) has reviewed the environmental effects of river channel engineering works, particularly the impact on fish habitat and ecology: this paper seeks to identify the principal effects of channelization on a variety of wildlife resources dependent upon in-stream and bankside habitats (Fig. 4).







River channelization also decreases habitat diversity in rivers which include riffles and pools consequently.